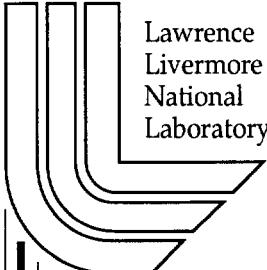


Technical Progress Report on Single Pass Flow Through Tests of Ceramic Waste Forms for Plutonium Immobilization

P. Zhao, S. Roberts, W. Bourcier

December 1, 2000

U.S. Department of Energy



Lawrence
Livermore
National
Laboratory

DISCLAIMER

This document was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor the University of California nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or the University of California. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or the University of California, and shall not be used for advertising or product endorsement purposes.

This work was performed under the auspices of the U. S. Department of Energy by the University of California, Lawrence Livermore National Laboratory under Contract No. W-7405-Eng-48.

This report has been reproduced directly from the best available copy.

Available electronically at <http://www.doc.gov/bridge>

Available for a processing fee to U.S. Department of Energy
And its contractors in paper from
U.S. Department of Energy
Office of Scientific and Technical Information
P.O. Box 62
Oak Ridge, TN 37831-0062
Telephone: (865) 576-8401
Facsimile: (865) 576-5728
E-mail: reports@adonis.osti.gov

Available for the sale to the public from
U.S. Department of Commerce
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161
Telephone: (800) 553-6847
Facsimile: (703) 605-6900
E-mail: orders@ntis.fedworld.gov
Online ordering: <http://www.ntis.gov/ordering.htm>

OR

Lawrence Livermore National Laboratory
Technical Information Department's Digital Library
<http://www.llnl.gov/tid/Library.html>

**Technical Progress Report on Single Pass Flow Through Tests of
Ceramic Waste Forms for Plutonium Immobilization**

Pihong Zhao
Sarah Roberts
William Bourcier

Lawrence Livermore National Laboratory

December, 2000

INTRODUCTION

This report updates work on measurements of the dissolution rates of single-phase and multi-phase ceramic waste forms in flow-through reactors at Lawrence Livermore National Laboratory. Previous results were reported in Bourcier (1999)*.

Two types of tests are in progress: (1) tests of baseline pyrochlore-based multiphase ceramics; and (2) tests of single-phase pyrochlore, zirconolite, and brannerite (the three phases that will contain most of the actinides). Tests of the multi-phase material are all being run at 25°C. The single-phase tests are being run at 25°, 50°, and 75°C. All tests are being performed at ambient pressure. The as-made bulk compositions of the ceramics are given in Table 1.

The single pass flow-through test procedure [Knauss, 1986 #140] allows the powdered ceramic to react with pH buffer solutions traveling upward vertically through the powder. Gentle rocking during the course of the experiment keeps the powder suspended and avoids clumping, and allows the system to behave as a continuously stirred reactor. For each test, a cell is loaded with approximately one gram of the appropriate size fraction of powdered ceramic and reacted with a buffer solution of the desired pH. The buffer solution compositions are given in Table 2.

All the ceramics tested were cold pressed and sintered at 1350°C in air, except brannerite, which was sintered at 1350°C in a CO/CO₂ gas mixture. They were then crushed, sieved, rinsed repeatedly in alcohol and distilled water, and the desired particle size fraction collected for the single pass flow-through tests (SPFT). The surface area of the ceramics measured by BET ranged from 0.1 - 0.35 m²/g. The measured surface area values, average particle size, and sample weights for each ceramic test are given in the Appendices.

* Bourcier, W. L. (1999). Interim report on development of a model to predict dissolution behavior of the titanate waste form in a repository and compilation of data from SPFT ceramic dissolution tests (FY99 milestones 4.1e and 4.1f), Lawrence Livermore National Laboratory, UCRL-ID-135363, PIP-00-003. 55 p.

Table 1. Compositions of ceramics used in SPFT dissolution tests.

Oxide	Element	P104				Impure Feed (Batch 4)			
		Oxide wt%	Element mole %	Oxide wt%	Element mole %	Oxide wt%	Element mole %	Oxide wt%	Element mole %
	O	--	--	25.1	63.6	--	--	24.1	63.8
CaO	Ca	12.6	25.0	9.0	9.1	9.9	21.2	7.1	7.5
UO ₂	U	30.2	12.5	26.7	4.5	23.6	10.5	20.8	3.7
PuO ₂	Pu	--	--	--	--	11.9	5.2	10.5	1.8
CeO ₂	Ce	9.6	6.3	7.8	2.3	--	--	--	--
Gd ₂ O ₃	Gd	--	--	--	--	7.9	2.6	6.9	1.8
TiO ₂	Ti	35.8	50.0	21.4	18.2	35.9	54.1	21.5	19.0
HfO ₂	Hf	11.8	6.3	10.0	2.3	10.6	6.1	9.0	2.1
Ga ₂ O ₃	Ga	--	--	--	--	0.14	0.09	0.10	0.06
ZnO	Zn	--	--	--	--	0.11	0.14	0.07	0.05
MgO	Mg	--	--	--	--	0.02	0.06	0.01	0.02
		P139 (zirconolite ceramic)				P137 (pyrochlore ceramic)			
Oxide	Element	Oxide wt%				Oxide wt%			
		Oxide wt%	Element mole %	Oxide wt%	Element mole %	Oxide wt%	Element mole %	Oxide wt%	Element mole %
	O			24.9	64.0	--	--	24.9	63.8
CaO	Ca	9.7	20.2	6.9	7.1	10.5	21.7	7.5	7.7
UO ₂	U	16.1	7.0	14.2	2.5	24.3	10.4	21.4	3.7
PuO ₂	Pu	--	--	--	--	--	--	--	--
CeO ₂	Ce	6.4	4.3	5.2	1.5	8.4	5.7	6.9	2.0
Gd ₂ O ₃	Gd	6.9	2.2	6.0	1.6	8.1	2.6	7.1	1.8
TiO ₂	Ti	35.5	52.1	21.3	18.3	36.2	52.7	21.7	18.6
HfO ₂	Hf	25.4	14.1	21.5	5.0	12.5	6.9	10.6	2.4
Ga ₂ O ₃	Ga	--	--	--	--	--	--	--	--
ZnO	Zn	--	--	--	--	--	--	--	--
MgO	Mg	--	--	--	--	--	--	--	--
		Brannerite							
Oxide	Element	Oxide wt%							
		Oxide wt%	Element mole %	Oxide wt%	Element mole %				
	O	--	--	22.8	66.7				
UO ₂	U	61.1	31.7	53.9	10.6				
TiO ₂	Ti	38.9	68.3	23.3	22.8				

The flow-through tests were run at various flow rates ranging from 10 to 100 ml/day. The flow rates for each test are given in the Appendices. Peristaltic pumps were used to control flow rate. A debubbler cell was placed in line for each buffer solution. The

debubbler allows the gas exsolved during heating of the fluid to escape, avoiding the capture of bubbles inside the reaction chamber.

Table 2. Buffer solution compositions.

pH	Buffer Components	Concentration
pH 2	HCl	0.01 molal
pH 4	Potassium acid phthalate-HCl	0.001 molal
pH 6	Potassium acid phthalate-NaOH	0.001 molal
pH 8	Boric acid-NaOH	0.005 molal
pH 8.5	NaHCO ₃	0.005 molal
pH 10	Boric acid-NaOH	0.005 molal
pH 12	NaOH	0.01 molal
pH 12	Na ₂ CO ₃ -NaOH	0.01 molal
pH 12	K ₂ HPO ₄ -NaOH	0.01 molal

The reacted solutions were periodically sampled, weighed to determine flow rates, and analyzed by ICP/MS for cerium, gadolinium, hafnium, titanium, and uranium. The concentration data were used to compute the normalized release rate, which is defined as:

$$NR_i = \frac{C_i * Q}{S * m * X_i}$$

where C_i is the blank-corrected concentration of element i in the buffered leach solution (per unit volume), Q is the solution flow rate, S is the BET-measured specific surface area of the ceramic, m is the mass of ceramic, and X_i is the weight fraction of element i in the ceramic. Normalized release rates in units of g/m²/day for each element are given in the Appendices.

SUMMARY OF DATA

Tests of the U-Pu multi-phase pyrochlore-based ceramic waste form

The SPFT tests of the plutonium-bearing pyrochlore-based ceramic were carried out in pH buffers of 2, 4 and 6 at room temperature. The tests have been ongoing for 34 months. Figure 1 shows the dissolution rates of Pu and U as a function of time at the three pH values tested. Release rates are highest at low pH. At a given time and pH, the normalized release rates for U and Pu are approximately the same. The release rates decrease with time, and the effect of pH tends to decrease with time.

Figure 2 compares the dissolution rates of all the elements (except Ca) in the U-Pu ceramic at each pH tested. The elemental release becomes more non-stoichiometric as the solution pH increases from 2 to 6. However, even at pH 6, elemental releases become more congruent with time. The concentrations of some elements such as Hf and Ti in pH 6 leachate are near or below the detection limits of ICP-MS. The amounts of Ca released from the ceramic were below background because of the high background levels of Ca under standard laboratory conditions.

Tests of the U-Ce multi-phase pyrochlore-based ceramic waste form

Two sets of room temperature SPFT tests of the U-Ce ceramic are in progress; tests at pH 2, 4, 6, and 8; and tests at pH 9, 10 and 12. Ce serves as an analog for Pu in these ceramics. Because the ceramic contains no Pu the tests do not need to be performed in a glovebox. The pH 2-8 tests have been ongoing for 35 months. The pH 9-12 tests have been ongoing for 28 months. Figure 3 shows the normalized release rates for elements in the U-Ce pyrochlore ceramic waste form as a function of time. The data trends are consistent with those obtained from the tests of U-Pu ceramic samples. The normalized release rates of uranium at pH 2 to 9 clearly continued to decrease for the duration of the tests; however, the release rates at higher pHs seem to have leveled off between 1.5 and 2 years. Note that although Ce and U are released congruently at low pH values (Figure 3),

at pH 8 and higher, U is released faster than Ce. This probably is due to a lower relative solubility of Ce vs. U at neutral to alkaline pH values.

At pH 12, three different buffers were used to study the effects of various anions (hydroxide, carbonate, and phosphate) on dissolution behavior. After a year of reaction, uranium release rates started showing a dependence on solution composition (see Figure 4a). The release rate of uranium in these buffers decreases in the order: $\text{Na}_2\text{CO}_3 > \text{NaOH} > \text{K}_2\text{HPO}_4$. The anion species apparently participate in the reactions controlling the release of U. However, Ti and Hf do not appear to be affected by the anion present, at the resolution of our tests (Figures 4b and 4c).

Two more SPFT tests (at pH 2 & 4) for the multiphase ceramic BSL8 (received from PNNL) at room temperature were started in February 2000. An earlier sample of this formulation tested at PNNL showed anomalous release rate data; normalized release rates for some elements increased with time. No analytical data are currently available from our tests on this material. Data on this test will be reported in the next data update.

Tests of U-Ce single-phase ceramics

SPFT tests on nominally single-phase pyrochlore¹ ($(\text{Ca},\text{Gd})(\text{Hf},\text{Ce},\text{U},\text{Gd})\text{Ti}_2\text{O}_6$), zirconolite ($(\text{Ca},\text{Gd})(\text{Hf},\text{Ce},\text{U},\text{Gd})\text{Ti}_2\text{O}_6$), and brannerite (UTi_2O_6) ceramics are being carried out at 25°, 50° and 75 °C over a pH range of 2-12. The tests of the pyrochlore and zirconolite have been in progress for 24 months. The tests of the brannerite have been in progress for 15 months. They are all currently being maintained at 75°C with infrequent sampling. It should be noted that these ceramics all contain small amounts of rutile and mixed Ti-Hf oxides (<10 volume %). The pyrochlore ceramic also contains a small amount of brannerite (<2 volume %). The presence of small amounts of other phases may affect the interpretation of the data.

² Although pyrochlore and zirconolite have the same chemical formula, the pyrochlore contains greater amounts of U and Ce and a lesser amount of Hf than zirconolite (see Table 1) and because of this crystallizes with a different structure.

Figures 5 to 7 show normalized uranium release rates observed in each phase at 25°, 50° and 75°C, respectively. Only uranium data are plotted. Uranium was generally above detection limits at all pH values and therefore shows the best trends. Other elements were detectable only under a subset of test conditions. The concentrations of all analyzed elements are given in Appendix C, D and E. In general, the highest release rates are obtained for brannerite with rates of $10^{-3} - 10^{-4}$ g/m²/day obtained at the longest durations. Rates for pyrochlore and zirconolite are typically an order of magnitude lower at similar pH and temperature.

The data show a progressive increase in non-stoichiometry of release as the pH increases from 2 to 10. At pH 2, Ca, U, Ce, and Ti are all released at nearly the same rate. At higher pH values, elements other than U leach at slower rates. Most of the data show a continuous decrease in release rate with time, similar to the Pu-U ceramic release rate data.

Summary of dissolution rates as function of pH

Figure 8 compares normalized release rates of uranium for both single phase and multi-phase ceramics as a function of pH at room temperature. The data are averages of measured values over the 90 to 120 day sampling period for all the ceramics except brannerite, for which the 19-26 day data were used. The error bars represent one standard deviation on the average of the analytical data. The curves show a general trend of decreasing dissolution rate with pH up to near neutral pH, with perhaps a minimum at neutral pH, and little or no effect of pH at higher pH values. The single phase zirconolite and pyrochlore ceramics are slightly more durable than the multiphase ceramics. The single phase brannerite is about two orders of magnitude less durable than the other single phase ceramics and the multi-phase ceramics. The multi-phase ceramics probably show higher release rates because they contain some of the less durable brannerite phase.

Figure 9 compares beginning and ending normalized release rates for uranium from multi-phase ceramics as a function of pH. With time, the release rates slow down, as

noted previously. However, the Ce-U ceramic release rate slows down more than the Pu-U ceramic release rate. This is better seen in Figure 10 where the ratio of the normalized release rate of U from the Pu-U ceramic over the normalized release rate of U from the Ce-U ceramic is shown as a function of time. A positive slope of the data indicate the durability of the Ce-U ceramic increases with time relative to the Pu-U ceramic. The implication is that the data may be showing radiation damage due to alpha decay of Pu in the Pu-U ceramic that is not present in the Ce-U ceramic. A preliminary calculation indicates that something near ten to the twentieth atoms per cm³ would have been displaced from their lattice sites by reason of the alpha decay by during the three year test duration (Rich Van konynenburg, pers. com.). There are a few times ten to the twenty-first atoms per cm³ for this high material, so a couple % the atoms may have been displaced. Whether this trend is real and whether radiation damage is the cause cannot be determined with a high degree of certainty given the uncertainty of these data.

CONCLUSIONS

Some generalizations can be made based on these test results. The normalized release rates for most elements continue to decrease with time, although for some materials and pH conditions, they appear to be at or near steady state (after 3 years). There appear to be no cases where the release rates accelerate dramatically as has been observed in multi-year tests of silicate glasses. At low pH values, Hf is released more slowly and Gd at about the same rate as Pu. At neutral to alkaline pH values, all of these elements are released at rates so slow that analytical limitations make it difficult to determine relative release rates with much certainty.

The single phase tests consistently show that brannerite is the least durable phase, by 1-2 log units. Zirconolite and pyrochlore appear to be comparable in durability, especially when a correction is made for the small amount of brannerite present in the pyrochlore material.

With time, the effect of pH on dissolution rate becomes less pronounced, except perhaps for the single phase brannerite.

And finally, in tests at pH 12 with three different anions present (hydroxide, carbonate, and phosphate), carbonate appears to enhance the dissolution rate relative to simple hydroxide, and phosphate decreases the rate relative to simple hydroxide. But the overall effect of the anions is a factor of 10 or less.

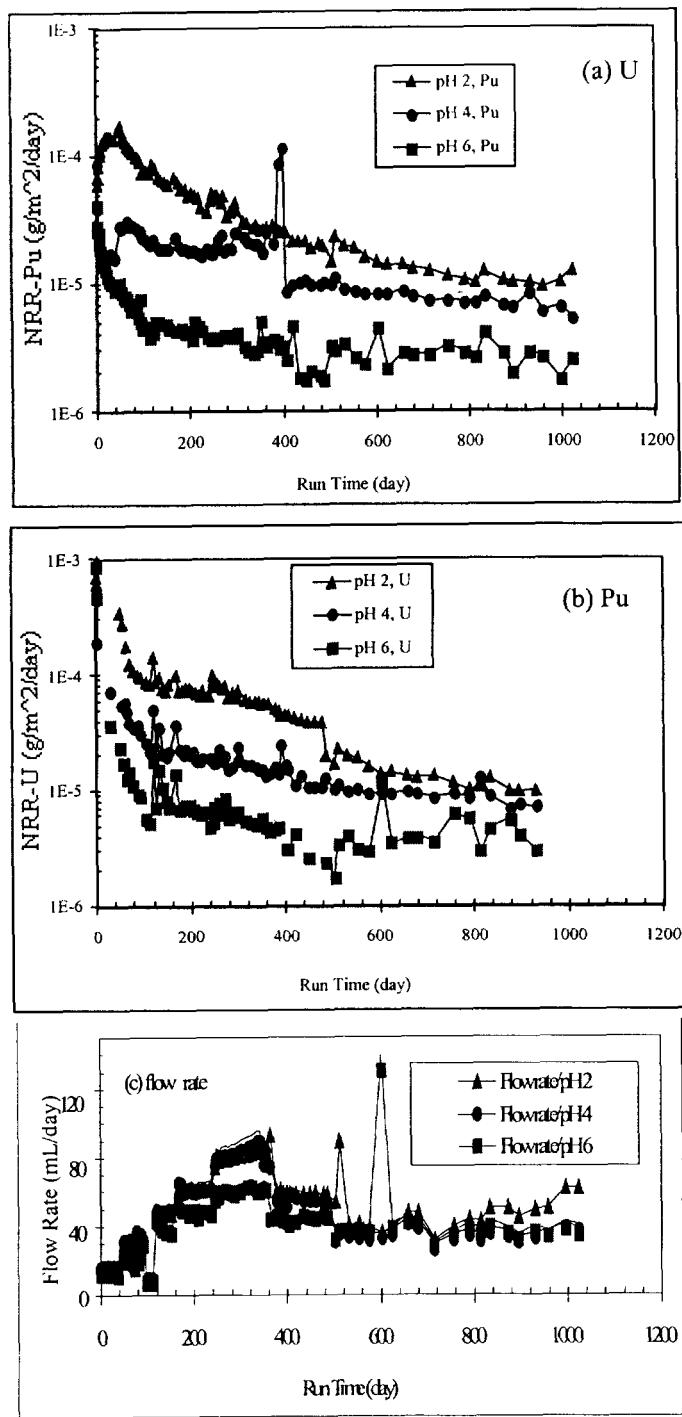


Figure 1. Normalized release rates of elements from the U-Pu multi-phase pyrochlore -based ceramic waste form (Impure Feed, batch 4). (a) normalized release rate of Pu, (b) normalized release rate of U, and (c) flow rates.

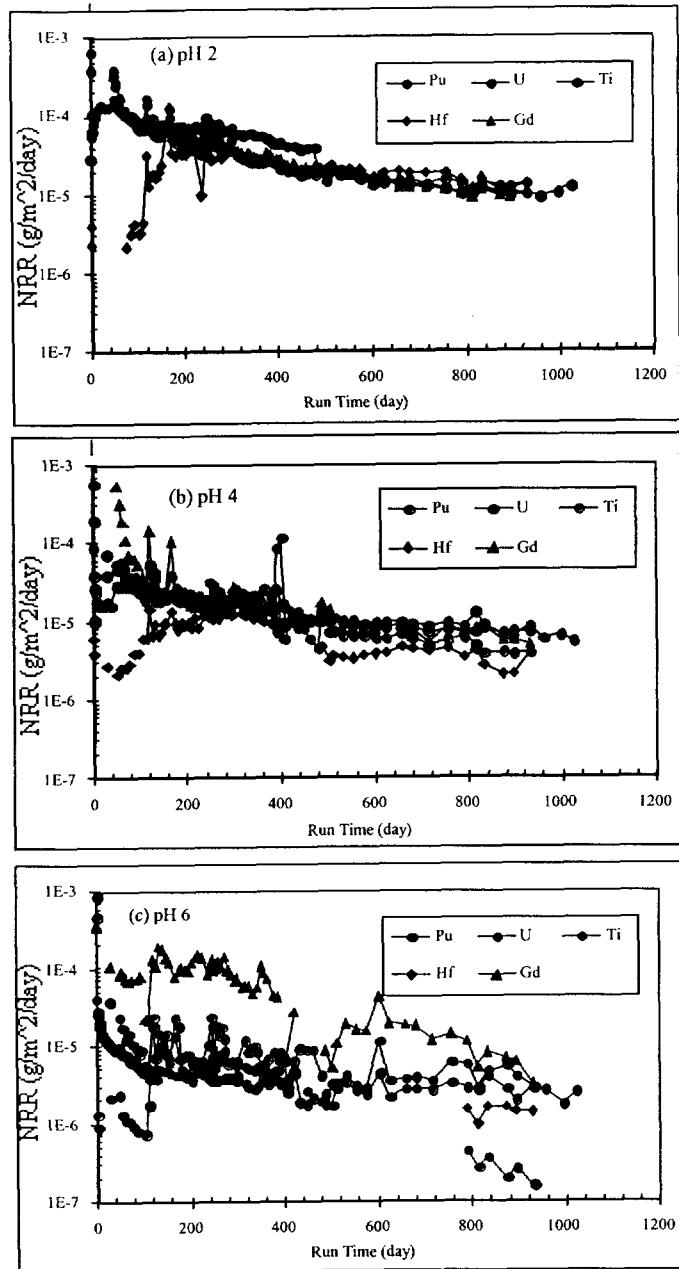


Figure 2. Normalized release rates of plutonium, uranium, titanium, hafnium and gadolinium in U-Pu multi-phase pyrochlore ceramic waste form (Impure Feed, batch 4) at pH (a) 2, (b) 4, and (c) 6

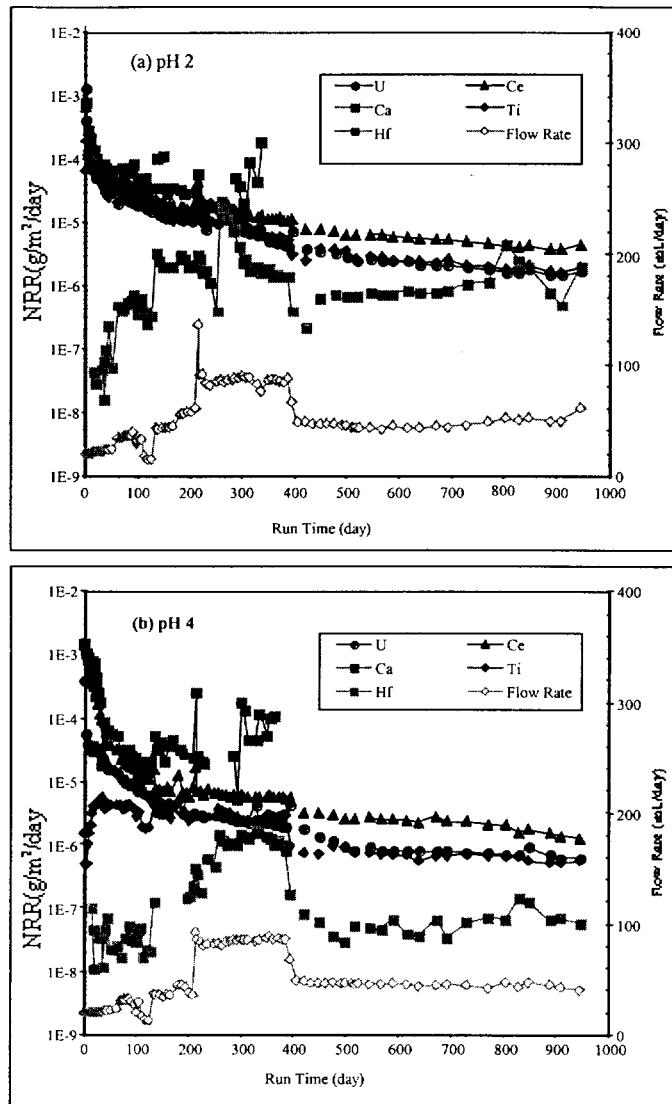


Figure 3. Normalized release rates of major elements in U-Ce multi-phase pyrochlore ceramic waste form (P104) and flow rates at pH (a) 2, (b) 4.

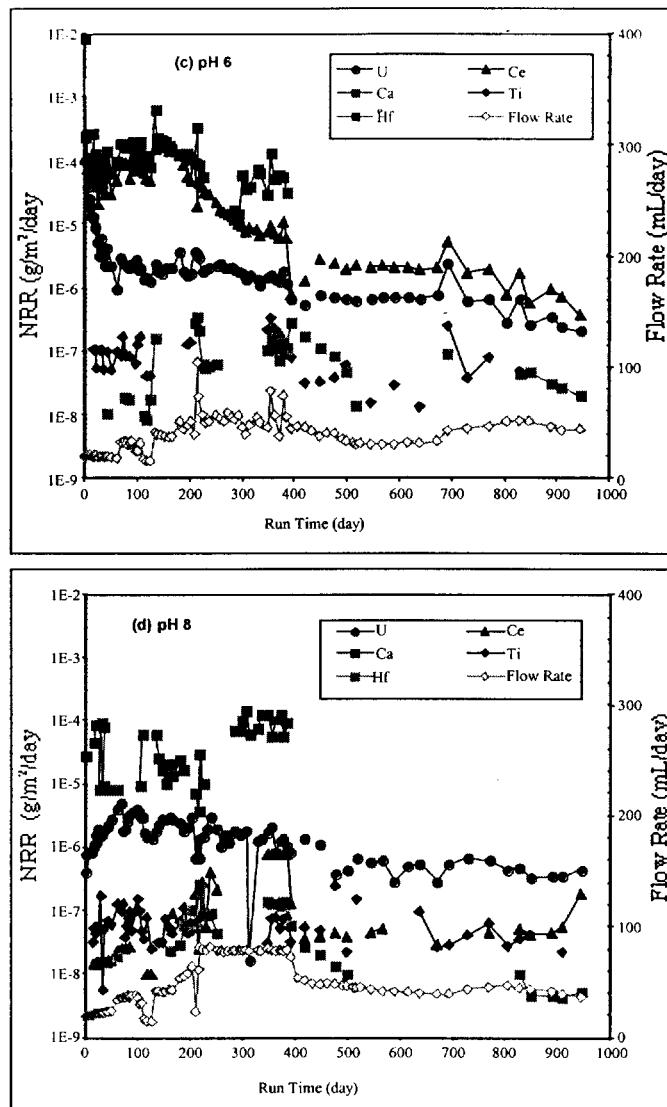


Figure 3 (cont.). Normalized release rates of major elements in U-Ce multi-phase pyrochlore ceramic waste form (P104) and flow rates at pH (c) 6, (d) 8.

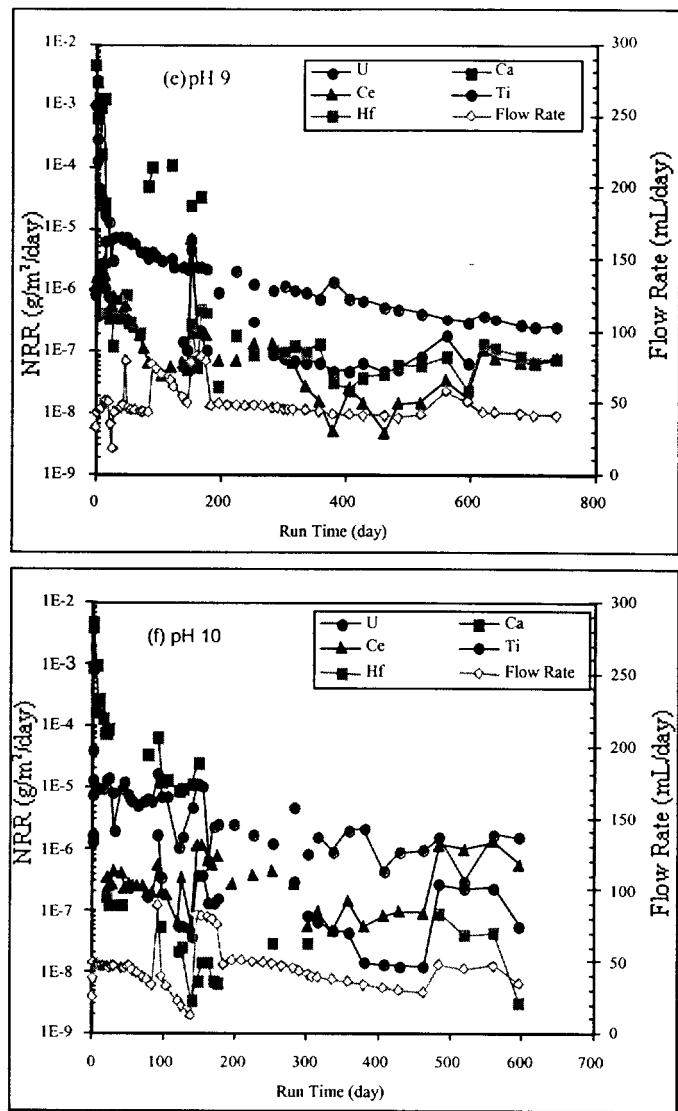


Figure 3 (cont). Normalized release rates of major elements in U-Ce multi-phase pyrochlore ceramic waste form (P104) and flow rates at pH (e) 9, (f) 10.

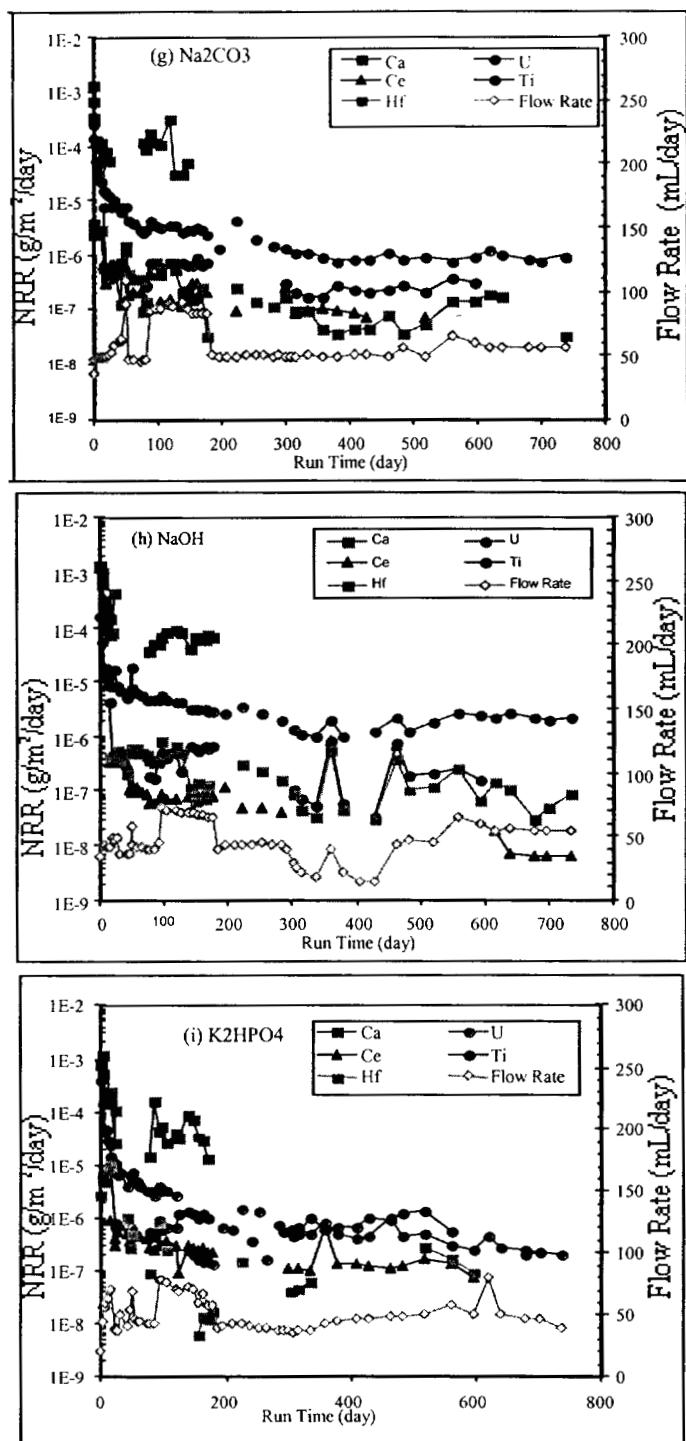


Figure 3 (cont). Normalized release rates of major elements in U-Ce multi-phase pyrochlore ceramic waste form (P104) and flow rates in three different buffers (g) Na_2CO_3 , (h) NaOH , and (i) K_2HPO_4 at pH 12.

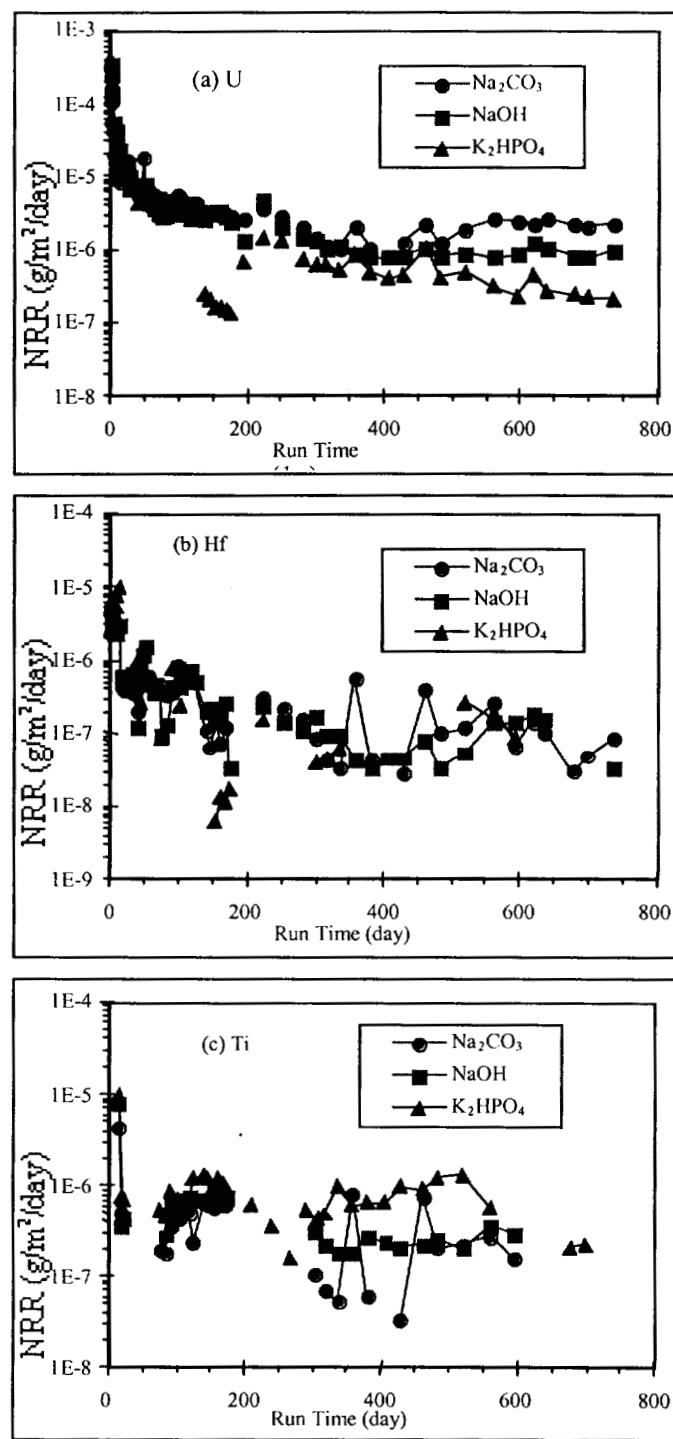


Figure 4. Effects of pH buffer chemistry on the dissolution rates of (a) U, (b) Hf and (c) Ti in U-Ce multi-phase pyrochlore-based ceramic waste form at pH 12.

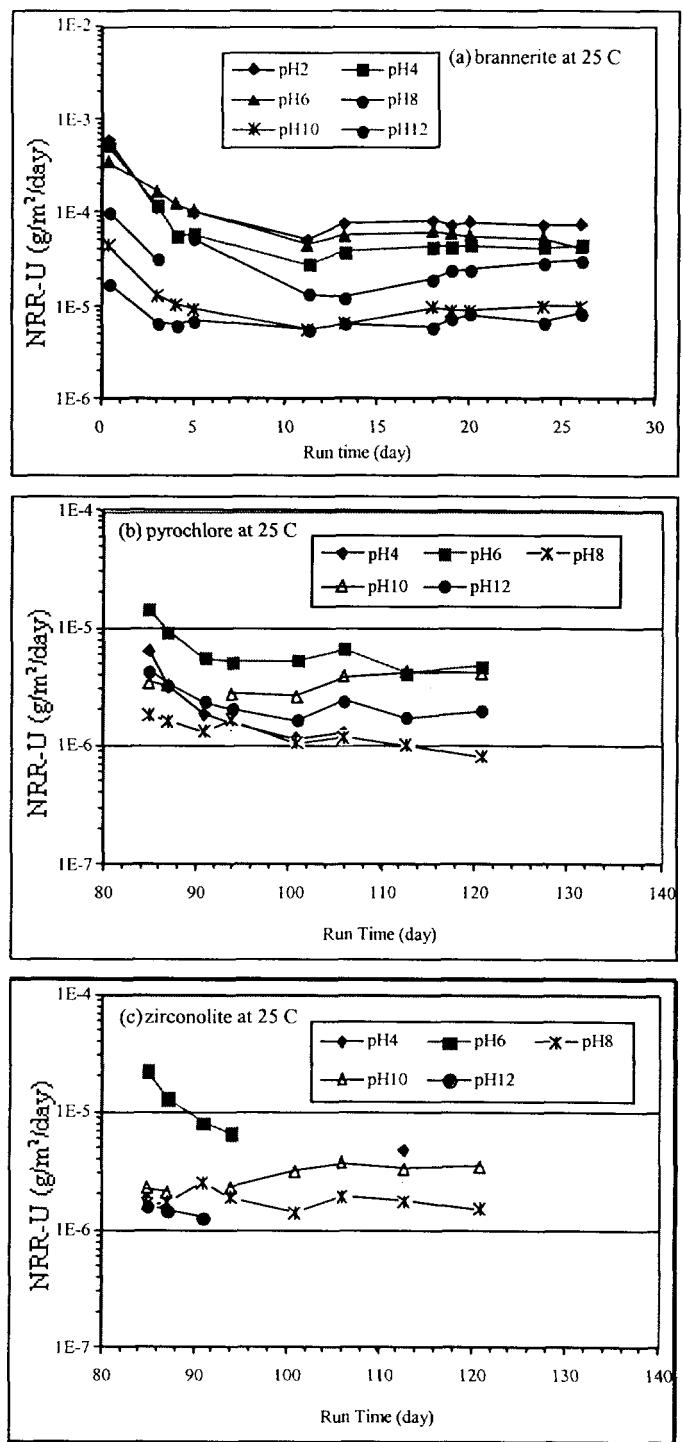


Figure 5. Normalized release rates of uranium from single-phase ceramics at 25° C for (a) brannerite, (b) pyrochlore, and (c) zirconolite. As-batched bulk compositions given in Table 1.

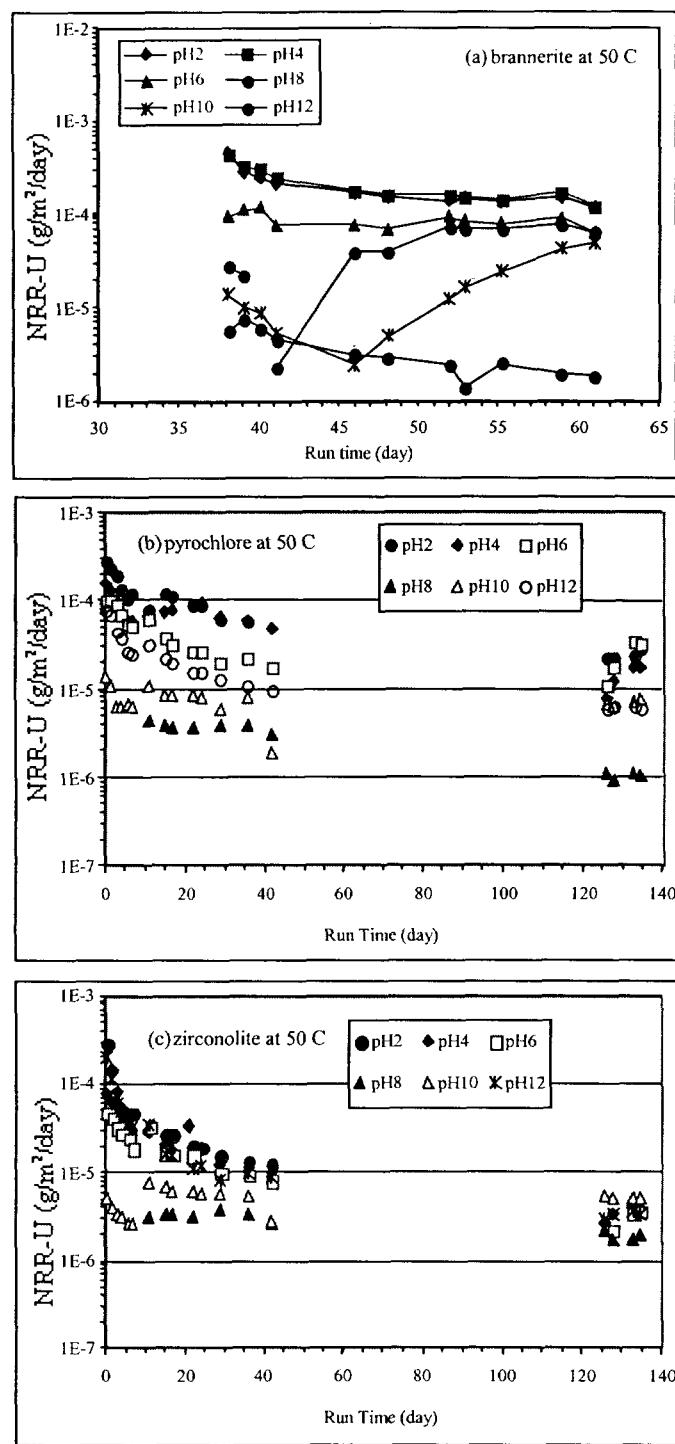


Figure 6. Normalized release rates of uranium from single-phase ceramics at 50° C for (a) brannerite, (b) pyrochlore, and (c) zirconolite.

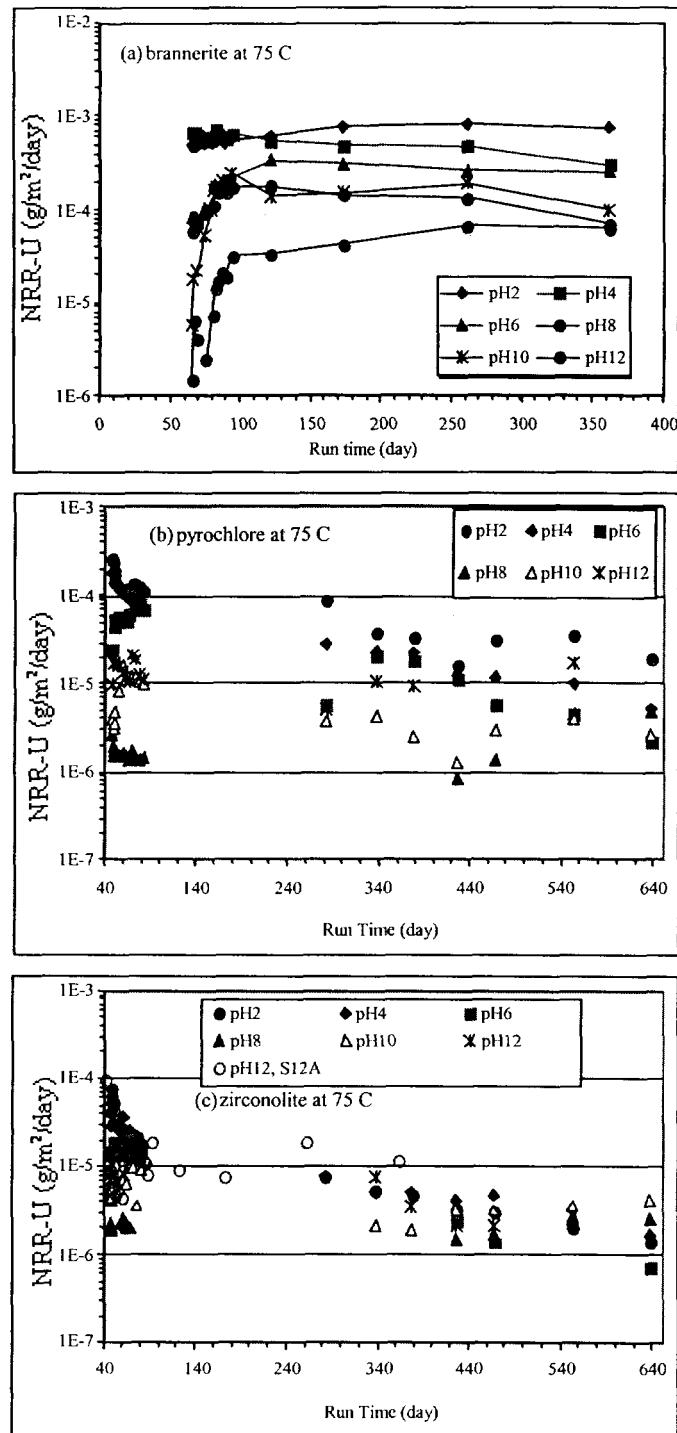


Figure 7. Normalized release rates of uranium from single-phase ceramics at 75° C for (a) brannerite, (b) pyrochlore, and (c) zirconolite.

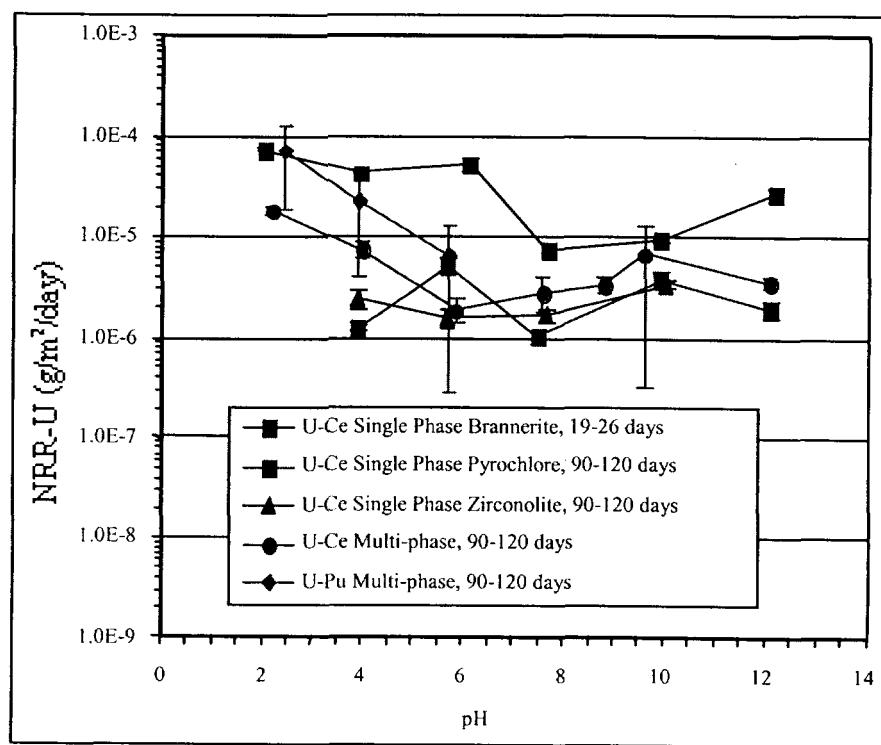


Figure 8. Comparison of dissolution rates of uranium from multi-phase and single phase tests as a function of pH at 25° C.

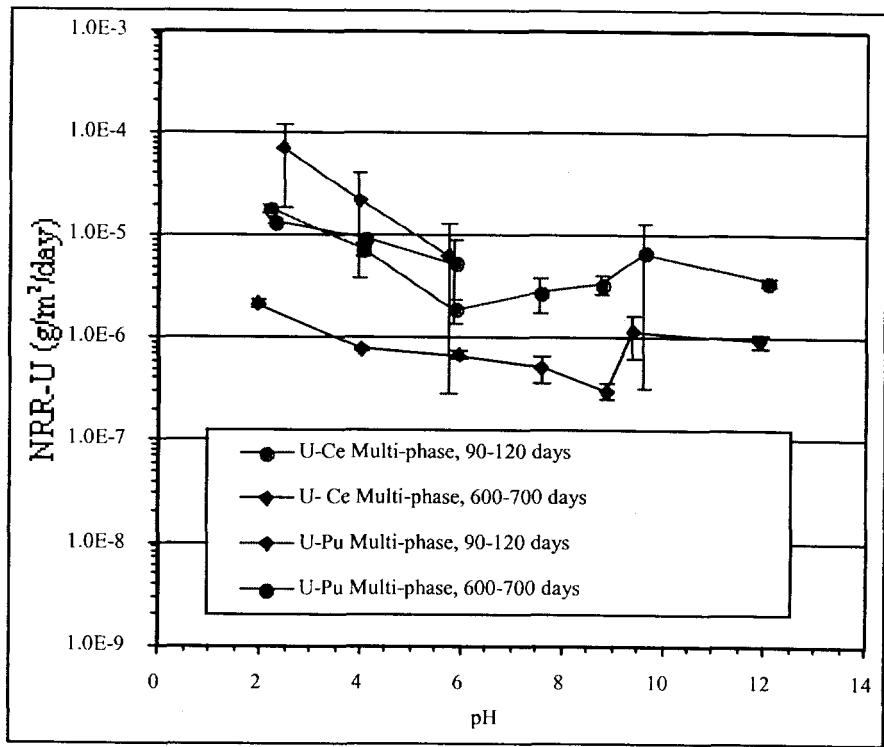


Figure 9. Comparison of dissolution rates of uranium from U-Ce vs. U-Pu ceramics as a function of pH at room temperature.

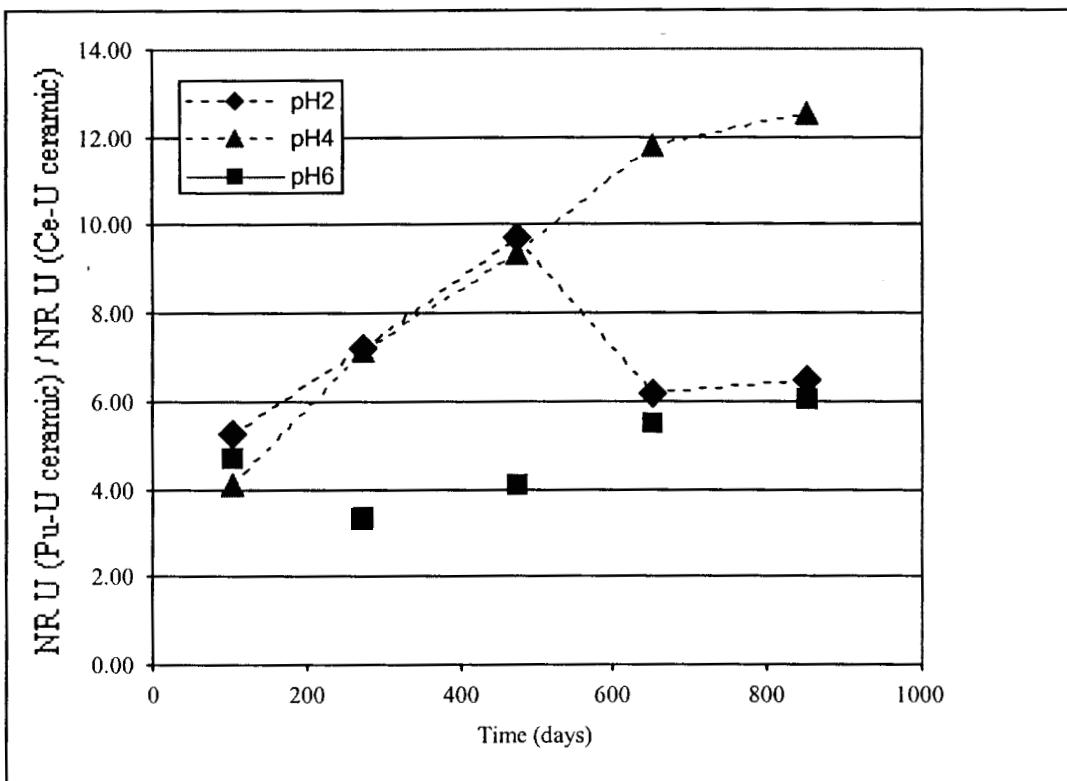


Figure 10. Comparison of uranium release rates from Pu-U and Ce-U ceramics. The ratio of NR of U from the Pu-U ceramic over the NR of U from the Ce-U ceramic is plotted vs. time. At greater times, the relative durability of the Ce-U ceramic increases relative to the Pu-U ceramic, perhaps indicating some deterioration in durability due to radiation damage by Pu in the Pu-U ceramic.

Appendices

The appendices contain all data obtained from the single-pass flow through tests of the ceramic waste forms.

- Appendix A. Pu-U Multi-phase Pyrochlore-based Ceramic Waste Form
- Appendix B. Ce-U Multi-phase Pyrochlore-based Ceramic Waste Form
- Appendix C. Ce-U Single Phase Zirconolite
- Appendix D. Ce-U Single Phase Pyrochlore
- Appendix E. Ce-U Single Phase Brannerite

Notes:

1. Surface areas measured using nitrogen BET. Surface area of Pu-U ceramic material was estimated based on particle size and comparison with BET measurements of Ce-U material.
2. “Mass” refers to mass of ceramic powder used in test.
3. “Surf Area” is calculated surface area based on starting mass, BET measurement, and a correction term that takes into account surface area loss over duration of experiment as particles decrease in size. The calculation assumes smooth spherical particles and is based on uranium normalized release rates.
4. “NR” refers to normalized release rates for the element as defined on page 4 of text.
5. “% loss” is calculated mass loss assuming stoichiometric dissolution and is based on uranium release. Uranium is generally the fastest released element. The % loss is therefore a conservative upper limit on total mass released.
6. “Calc thickness” is the calculated thickness of material dissolved from the particle surface. As with ‘% loss’, it is calculated from the normalized release rate of uranium and assumes stoichiometric dissolution. As such it provides an estimate of the total amount of particle dissolution. “Calc thickness” can also be used as an estimate of the surface leached layer thickness assuming uranium is preferentially released from the surface layer and the titanate framework remains. The more relevant interpretation depends on the pH of the test. At low pH values where release is nearly congruent, ‘Calc thickness’ corresponds to the thickness of material that has been dissolved from the surface. At neutral pH values where release is incongruent (uranium is released more quickly than Ti, Hf and other elements), it is a better estimate for leached layer thickness.

Appendix A

Pu-U Multi-phase Pyrochlore-based Ceramic Waste Form

Pu Dissolution Project (Pu samples)
Experiments Started on:
7/22/97 4:00 PM

pH 2.6

Sample: Pu-U Ceramics
Starting SA= 0.1 m²/g
eramic density 5.2 g/cm³ purple=estimate
5.200E-12 g/ μm^3

Element	WtFracElement	Surface Area Calculation assume spherical particles diameter(microns) = 11.538 # Particles/g = 2.39E+8
Ti	0.2152	
O	0.2130	
U	0.2080	
Pu	0.1050	
Hf	0.0899	
Ca	0.0708	
Gd	0.0685	
Ga	0.0010	
Zn	0.0007	
Mg	0.0001	
sum	0.97	

Formulas for cell uptake
Net Rate= Concentration(ppb) * 0.00001 / FlowRate(ml/day) * 0.001 / SampleMass(g) / SurfaceArea(m²/g) * Wt.Fraction
SampleMass= init. wt. - (days elapsed * FlowRate (ml/day) * ((ppbC_U_WtFraction)*(ppbC_G_WtFraction))^(1/2))
Diameter= 2 * SampleMass/(0.73 % Density(g/mc.) * #Particles)
Initial Diamter is assumed to be the same for all runs.
Surface Area (m²/g) = # Particles*4*π*(Diameter(m)/2)²*10⁻¹²
Particles= Sample Mass (g) * # Particles/g/mm
Particles/g = Surface Area (m²/g)*4*π*(Initial Diameter(m)/2)²*10⁻¹²
**Value of # Particles is kept constant throughout all runs.
Initial Diameter (um)= 2^(3/2)*SurfaceArea(10⁻¹²m²/g)*Density(g/(10⁻¹²mm))

25 C data	Mass	Ceramics	Flow Rate	Run time	Diameter	Surf. Area	pH	Pu	U	Hf	Gd	Ga	Ca	Ti	Zn	Mg	NR-Pu	NR-U	NR-Hf	NR-Gd	NR-Ga	NR-Ca	NR-Ti	NR-Zn	NR-Mg	#Particles		
	(g)	(ml/day)	(days)	(microns)	(sq. m)	(sq. m)		ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	g/m ² /day											
Pu201	0.99998	14.851	0.4	11.538	0.10000	2.59	20.650	41.040	1467	1.4	4862.0					161.0	5.82E-5	1.05E-3	2.32E-6	1.06E-2			1.11E-4		239086294			
Pu202	0.99987	14.882	1.2	11.538	0.09999	2.59	41.040	1467	1.4	4862.0						571.0	6.67E-5	6.80E-4	3.96E-6	2.49E-3			3.94E-4		239086294			
Pu203	0.99968	14.840	2.4	11.537	0.09998	2.51	47.180	953	2.4	1148.0																239086294		
Pu204	0.99959	15.037	3.0	11.537	0.09997	2.44	46.031																				239086294	
Pu205	0.99906	14.840	5.8	11.535	0.09994	2.39	58.740																				239086294	
Pu206	0.99860	14.841	7.9	11.533	0.09991	2.48	70.980																				239086294	
Pu207	0.99810	14.909	9.9	11.531	0.09987	2.56	78.010																				239086294	
Pu208	0.99726	15.002	12.9	11.528	0.09982	2.51	86.290																				239086294	
Pu209	0.99641	15.036	15.9	11.525	0.09976	2.52	88.230																				239086294	
Pu210	0.99514	14.995	19.9	11.520	0.09968	2.57	98.170																				239086294	
Pu211	0.99419	14.970	22.9	11.516	0.09951	2.60	98.770																				239086294	
Pu212	0.99236	15.014	26.9	11.511	0.09953	2.58	95.030																				239086294	
Pu213	0.99203	15.027	29.9	11.501	0.09947	2.56	95.030																				239086294	
Pu214	0.98962	15.185	37.9	11.498	0.09931	2.52	92.210																				239086294	
Pu215	0.98543	30.234	48.9	11.492	0.09903	2.54	58.820	236	ND<0.5	76.00						273.00		1.72E-4	3.51E-4	3.43E-4			3.92E-4			239086294		
Pu216	0.98439	30.209	51.8	11.478	0.09896	2.44	54.550																				239086294	
Pu217	0.98310	30.206	55.9	11.473	0.09887	2.50	48.670	189	ND<0.5	59.00						179.00		1.44E-4	2.82E-4	2.67E-4			2.58E-4			239086294		
Pu218	0.98227	30.304	58.8	11.470	0.09881	2.48	43.500																				239086294	
Pu219	0.98126	30.439	62.4	11.466	0.09875	2.43	43.200	118	ND<0.5	40.00						126.00		1.29E-4	1.78E-4	1.83E-4			1.84E-4			239086294		
Pu220	0.98034	30.256	65.8	11.462	0.09868	2.47	41.220																				239086294	
Pu221	0.97930	30.262	69.9	11.458	0.09862	2.45	39.460	83	ND<0.5	28.00						87.00		1.18E-4	1.25E-4	1.28E-4			1.27E-4			239086294		
Pu222	0.97856	30.295	72.9	11.455	0.09857	2.43	37.790																				239086294	
Pu223	0.97762	32.308	76.9	11.452	0.09850	2.50	33.580	69	0.60	23.00						72.00		1.07E-4	1.11E-4	2.24E-6	1.13E-4			1.12E-4			239086294	
Pu224	0.97612	32.009	83.9	11.446	0.09840	2.42	31.300																				239086294	
Pu225	0.97548	30.975	86.9	11.443	0.09836	2.47	31.900	68	0.90	22.00						67.00		9.80E-5	1.02E-4	3.23E-6	1.04E-4			1.00E-4			239086294	
Pu226	0.97463	31.282	90.9	11.440	0.09830	2.50	30.880																				239086294	
Pu227	0.97405	30.980	93.9	11.438	0.09826	2.50	29.670	63	1.20	21.00						62.00		9.11E-5	9.77E-5	4.30E-6	9.89E-5			9.29E-5			239086294	
Pu228	0.97333	8.639	98.3	11.435	0.09821	2.50	87.830																				239086294	
Pu229	0.97222	8.654	105.0	11.431	0.09814	2.45	88.870	203	3.30	64.00						165.00		7.67E-5	8.85E-5	3.33E-6	8.47E-5			6.95E-5			239086294	
Pu230	0.97093	8.679	113.0	11.426	0.09805	2.45	85.920	195	4.40	63.00	1.20	91.90				165.30	45.9	7.45E-5	8.54E-5	4.46E-6	8.38E-5	1.09E-4		7.00E-5	5.97E-3		239086294	
Pu231	0.96878	47.309	119.9	11.417	0.09778	2.29	18.320	61	5.80	15.00						51.10	75.50	31.8	8.69E-5	1.46E-5	3.21E-5	1.09E-4			3.59E-4	1.75E-4	2.26E-2	239086294
Pu232	0.96687	46.939	125.4	11.410	0.09778	2.45	17.200	38	2.40	10.60	ND<1	13.60				31.20	2.4	8.13E-5	9.07E-5	1.33E-5	7.68E-5			9.54E-5	7.20E-3		239086294	
Pu233	0.96576	47.038	132.9	11.405	0.09770	2.33	14.560	41	3.40	11.80	ND<1	25.00				34.70	24.2	6.91E-5	9.82E-5	1.88E-5	8.58E-5			1.76E-4	8.03E-5	1.72E-2	239086294	
Pu234	0.96477	46.819	139.9	11.401	0.09764	2.30	14.090	33	3.10	8.90	ND<1	22.00				25.60	27.8	6.67E-5	7.88E-5	1.71E-5	6.45E-5			1.54E-5	5.91E-5	1.97E-2	239086294	
Pu235	0.96382	46.868	146.9	11.398	0.09757	2.47	13.460	31	3.70	8.50	ND<1	24.50				24.80	33.7	6.38E-5	7.42E-5	2.05E-5	6.18E-5			1.72E-4	5.74E-5	2.40E-2	239086294	
Pu236	0.96304	46.784	152.9	11.395	0.09752	2.42	12.910	35	4.50	9.60	ND<1	21.40				26.90	23.7	6.12E-5	8.38E-5	2.49E-5	6.98E-5			1.50E-4	6.22E-5	2.40E-2	239086294	
Pu237	0.96077	61.944	166.0	11.386	0.09699	2.22	7.592	22	5.10	5.40	ND<1	16.10				41.50	21.0	7.08E-5	1.02E-4	3.12E-4	8.40E-5			3.88E-4	1.31E-4	7.04E-2	239086294	
Pu238	0.95986	61.169	174.9	11.381	0.09695	2.09	6.812	24	5.10	5.80	ND<1	4.50	20.30			18.30	51.3	6.32E-5	7.55E-5	3.49E-5	5.83E-5			1.26E-4	5.57E-5	4.80E-2	239086294	
Pu239	0.95901	61.348	181.9	11.379	0.09725	2.51	9.155	22	1.40	5.20	ND<1	17.40				10.80	64.5	5.73E-5	7.59E-5	3.22E-5	5.57E-5			1.62E-4	5.13E-5		239086294	
Pu240	0.95818	61.228	188.9	11.375	0.09719	2.42	8.957	25	4.90	6.10	ND<1	16.60				17.60	25.3	5.61E-5	7.90E-5	3.58E-5	5.85E-5			1.54E-4	5.37E-5	2.37E-2	239086294	
Pu241	0.95743	61.878	195.9	11.372	0.09714	2.37	8.008	25	4.60	6.00	ND<1	21.10				16.70	23.7</											

Pu264	0.94460	79.602	350.9	11.321	0.09627	2.15	3.371	14	3.10	2.50	ND<1	6.90	7.60	19.9	2.81E-5	5.89E-5	3.02E-5	3.19E-5	8.53E-5	3.09E-5	2.49E-2	239086294	
Pu265	0.94432	86.605	355.9	11.320	0.09625	2.09	2.996	13	2.70	2.20	ND<1	7.20	6.00	18.6	2.72E-5	5.95E-5	3.06E-5	3.06E-5	9.69E-5	2.66E-5	2.53E-2	239086294	
Pu266	0.94384	93.193	363.9	11.318	0.09622	2.18	2.981	12	2.70	2.00	ND<1	9.70	5.60	21.9	2.91E-5	5.92E-5	3.08E-5	3.00E-5	1.41E-4	2.67E-5	3.21E-2	239086294	
Pu267	0.94250	60.610	377.8	11.315	0.09616	2.33	4.690	17	4.20	3.70	ND<1	23.90	10.60	23.5	2.98E-5	5.46E-5	3.12E-5	3.61E-5	2.25E-4	3.29E-5	2.24E-2	239086294	
Pu268	0.94250	61.107	385.9	11.313	0.09613	2.31	4.563	16	4.00	3.40	ND<1	15.50	9.30	31.5	2.93E-5	5.19E-5	3.00E-5	3.35E-5	1.48E-4	2.91E-5	3.03E-2	239086294	
Pu269	0.94223	59.669	390.9	11.312	0.09611	2.24	4.187	15	3.80	2.90	ND<1	25.80	8.60	23.4	2.63E-5	4.75E-5	2.78E-5	2.79E-5	2.40E-4	2.63E-5	2.20E-2	239086294	
Pu270	0.94174	59.622	399.9	11.310	0.09608	2.29	4.282	15	3.60	3.00	ND<1	64.20	8.20	55.3	2.69E-5	4.75E-5	2.64E-5	2.88E-5	5.97E-4	2.51E-5	5.20E-2	239086294	
Pu271	0.94141	59.143	405.9	11.309	0.09605	2.20	4.310	15	3.60	3.00	1.90	12.40	7.70	25.2	2.68E-5	4.72E-5	2.62E-5	2.86E-5	1.24E-3	1.15E-4	2.34E-5	2.35E-2	239086294
Pu272	0.94076	58.950	419.9	11.306	0.09601	2.20	3.674	14	3.10	2.60	ND<1	25.60	7.30	28.0	2.28E-5	4.39E-5	2.25E-5	2.48E-5	2.36E-4	2.21E-5	2.61E-2	239086294	
Pu273	0.94010	58.572	433.9	11.303	0.09597	2.27	3.684	14	3.10	2.70	ND<1	34.30	6.90	41.6	2.28E-5	4.37E-5	2.24E-5	2.56E-5	3.14E-4	2.08E-5	3.86E-2	239086294	
Pu274	0.93946	58.790	447.9	11.301	0.09592	2.18	3.636	13	2.90	2.30	ND<1	19.00	6.30	56.1	2.26E-5	4.08E-5	2.10E-5	2.19E-5	1.75E-4	1.91E-5	5.23E-2	239086294	
Pu275	0.93893	59.319	460.9	11.299	0.09589	2.40	3.185	13	2.90	2.50	ND<1	32.30	7.30	34.5	2.00E-5	4.12E-5	2.12E-5	2.40E-5	3.00E-4	2.23E-5	3.25E-2	239086294	
Pu276	0.93819	58.984	477.9	11.296	0.09584	2.15	3.467	13	2.90	2.40	ND<1	19.40	6.20	18.4	2.16E-5	4.10E-5	2.12E-5	2.30E-5	1.80E-4	1.89E-5	1.72E-2	239086294	
Pu277	0.93784	58.580	485.9	11.294	0.09581	1.96	3.385	6.9	3.00	2.20			7.60		2.10E-5	2.16E-5	2.17E-5	2.09E-5		2.30E-5		239086294	
Pu278	0.93728	53.966	503.4	11.292	0.09577	2.17	2.771	6.1	2.30	1.90			8.30		1.59E-5	1.76E-5	1.54E-5	1.67E-5		2.32E-5		239086294	
Pu279	0.93688	89.687	511.4	11.290	0.09575	2.00	2.625	5	1.70	1.70			4.60		2.50E-5	2.40E-5	1.89E-5	2.48E-5		2.14E-5		239086294	
Pu280	0.93603	40.743	531.5	11.287	0.09569	2.10	4.792	9.7	3.90	3.10			9.00		2.07E-5	2.12E-5	1.97E-5	2.06E-5		1.90E-5		239086294	
Pu281	0.93513	41.729	553.4	11.283	0.09563	2.21	4.581	8.9	4.40	2.80			9.00		2.03E-5	2.00E-5	2.28E-5	1.91E-5		1.95E-5		239086294	
Pu282	0.93437	39.114	575.4	11.280	0.09558	2.34	4.127	8.2	4.40	2.70			8.50		1.72E-5	1.73E-5	2.14E-5	1.73E-5		1.73E-5		239086294	
Pu283	0.93352	36.328	602.4	11.277	0.09552	1.95	4.923	7.6	3.80	2.50			7.40		1.56E-5	1.49E-5	1.72E-5	1.49E-5		1.40E-5		239086294	
Pu284	0.93285	39.056	624.4	11.274	0.09547	2.35	3.614	7.3	4.10	2.40			8.10		1.51E-5	1.54E-5	2.00E-5	1.54E-5		1.65E-5		239086294	
Pu285	0.93185	47.974	657.3	11.270	0.09540	2.34	2.922	5.5	3.50	1.70			6.40		1.50E-5	1.43E-5	2.10E-5	1.34E-5		1.60E-5		239086294	
Pu286	0.93123	48.192	679.4	11.268	0.09536	2.32	2.735	5.3	3.20	1.70			6.40		1.41E-5	1.38E-5	1.93E-5	1.35E-5		1.61E-5		239086294	
Pu287	0.93024	31.893	715.4	11.264	0.09529	2.34	3.986	8.1	5.00	2.50			8.80		1.36E-5	1.40E-5	2.00E-5	1.31E-5		1.47E-5		239086294	
Pu288	0.92923	40.312	756.3	11.260	0.09522	1.87	2.848	5.7	3.90	1.80			8.00		1.23E-5	1.25E-5	1.97E-5	1.20E-5		1.69E-5		239086294	
Pu289	0.92845	44.424	790.4	11.256	0.09517	2.33	2.394	4.447	2.88	1.51			6.21		1.15E-5	1.07E-5	1.81E-5	1.11E-5		1.45E-5		239086294	
Pu290	0.92794	42.900	814.4	11.254	0.09514	2.03	2.329	4.809	2.27	1.32			5.27		1.08E-5	1.12E-5	1.23E-5	9.33E-6		1.19E-5		239086294	
Pu291	0.92744	50.883	833.4	11.252	0.09510	2.50	2.403	4.902	2.61	1.47			5.87		1.32E-5	1.36E-5	1.67E-5	1.23E-5		1.57E-5		239086294	
Pu292	0.92651	50.773	874.3	11.249	0.09504	2.19	2.077	3.858	1.87	1.18			5.17		1.14E-5	1.07E-5	1.20E-5	9.93E-6		1.38E-5		239086294	
Pu293	0.92604	45.253	895.4	11.247	0.09501	2.26	2.259	4.185	2.10	1.30			5.68		1.11E-5	1.03E-5	1.20E-5	9.79E-6		1.36E-5		239086294	
Pu294	0.92527	49.889	931.4	11.244	0.09495	2.22	2.013	3.943	2.26	1.38			5.53		1.09E-5	1.08E-5	1.43E-5	1.15E-5		1.46E-5		239086294	
Pu295	0.92473	50.565	958.4	11.241	0.09492	2.00	1.830	1.76	0.70	0.58			2.20		1.00E-5	4.87E-6	4.48E-6	4.88E-6		5.87E-6		239086294	
Pu296	0.92389	62.484	996.4	11.238	0.09486	2.04	1.648	3.10	1.60	0.99			4.04		1.12E-5	1.06E-5	1.27E-5	1.03E-5		1.34E-5		239086294	
Pu297	0.92337	61.724	1023.3	11.235	0.09481	2.05	2.017	2.59	1.25	0.83			3.56		1.35E-5	8.78E-6	9.80E-6	8.53E-6		1.17E-5		239086294	
Pu298	0.92277	78.394	1049.4	11.233	0.09478	2.04	0.910	1.77	0.54	0.56			2.48		7.77E-6	7.83E-6	5.38E-6	7.36E-6		1.03E-5		239086294	
Pu299	0.92149	29.481	1114.9	11.228	0.09469	2.02	3.070	6.30	1.18	1.91			8.76		9.87E-6	1.02E-5	4.43E-6	9.41E-6		1.37E-5		239086294	
Pu2100	0.92065	39.128	1163.3	11.225	0.09464	2.00	2.060	4.45	2.04	1.31			6.08		8.81E-6	9.60E-6	1.02E-5	8.81E-6		1.27E-5		239086294	
Pu2101	0.91943	81.394	1206.4	11.220	0.09455	2.08	1.620	3.64	1.70	1.19			5.26		1.44E-5	1.64E-5	1.77E-5	1.63E-5		2.29E-5		239086294	
average	0.93123																					239086294	
%loss	6.877																					239086294	

25 C data	Mass Ceramics	Flow Rate	Run time	Diameter	Surf. Area	pH	Pu	U	Hf	Gd	Ga	Ti	Zn	Mg	NR-Pu	NR-U	NR-Hf	NR-Gd	NR-Ga	NR-Ca	NR-Tl	NR-Zn	NR-Mg	#Particles			
ph 4	(g)	(mL/day)	(days)	(microns)	(sq. m)		ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	g/m^2/day												
start	1.00000		0.0	11.538	0.10000	4.10	58.940								8.85E-5	5.60E-5	5.98E-6	1.98E-3					239086294				
Pu401	0.99983	15.400	0.4	11.538	0.09999	4.28	26.680	758	3.5	881.0		14.0			3.91E-5	5.60E-4	5.98E-6	1.98E-3					239086294				
Pu402	0.99986	15.370	1.2	11.538	0.09999	4.28	26.680	259	2.2	613.0		15.0			2.69E-5	1.90E-4	3.73E-6	1.37E-3					239086294				
Pu403	0.99978	15.249	2.4	11.538	0.09998	4.34	18.510								2.39E-5									239086294			
Pu404	0.99975	15.433	3.0	11.538	0.09998	4.19	16.270								1.79E-5									239086294			
Pu405	0.99964	15.231	5.8	11.537	0.09998	4.10	12.350								1.66E-5									239086294			
Pu406	0.99956	15.264	7.9	11.537	0.09997	4.07	11.440								1.57E-5									239086294			
Pu407	0.99949	15.444	9.9	11.536	0.09997	4.07	10.930								1.61E-5									239086294			
Pu408	0.99938	15.540	12.9	11.536	0.09996	4.08	10.610								1.79E-5									239086294			
Pu409	0.99927	15.597	15.9	11.536	0.09995	4.03	10.690								1.59E-5									239086294			
Pu410	0.99913	15.555	19.9	11.535	0.09994	3.96	10.950								1.62E-5									239086294			
Pu411	0.99902	15.532	22.9	11.535	0.09993	4.00	10.920								1.62E-5									239086294			
Pu412	0.99887	15.640	26.9	11.534	0.09992	4.00	11.170								1.67E-5									239086294			
Pu413	0.99875	15.604	29.9	11.534	0.09992	4.00	11.630	95	1.5	795.0		52.0			1.73E-5	7.14E-5	2.61E-6	1.81E-3					239086294				
Pu414	0.99846	15.886	37.9	11.533	0.09990	3.98	10.460								1.58E-5									239086294			
Pu415	0.99776	31.402	48.9	11.530	0.09985	3.98	9.420								2.83E-5									239086294			
Pu416	0.99758	31.363	51.8	11.526	0.09984	3.88	9.090	36	0.6	117.0		32.0			2.73E-5	5.45E-5	2.10E-6	5.38E-4					239086294				
Pu417	0.99732	31.319	55.9	11.526	0.09982	3.94	9.510								2.85E-5									239086294			
Pu418	0.99713	31.420	58.8	11.527	0.09981	3.93	9.530	38	0.7	68.0		37.0			2.87E-5	5.77E-5	2.46E-6	3.13E-4					239086294				
Pu419	0.99690	31.616	62.4	11.527	0.09979	4.07	9.560	31	0.7	40.0		31.0			2.89E-5	4.74E-5	2.47E-6	1.86E-4					239086294				
Pu420	0.99667	31.464	65.8	11.526	0.09978	3.93	10.050								3.03E-5									239086294			
Pu421	0.99641	31.407	69.9	11.525	0.09976	3.98	9.350	26	0.7	23.0		26.0			2.81E-5	3.95E-5	2.46E-6	1.06E-4					239086294				
Pu422	0.99622	31.372	72.9	11.524	0.09975	3.94	9.380								2.82E-5									239086294			
Pu423	0.99597	35.951	76.9	11.523	0.09973	3.97	8.150	20	0.7	13.0		22.0			2.81E-5	3.48E-5	2.82E-6	6.87E-5					239086294				
Pu424	0.99554	34.940	83.9	11.521	0.09970	3.96	8.230								2.76E-5									239086294			
Pu425	0.99536	34.737	86.9	11.521	0.09969	3.94	7.990	22	1.0	12.0		23.0			2.66E-5	3.70E-5	3.89E-6	6.13E-5					239086294				
Pu426	0.99512	31.658	90.9	11.520	0.09967	3.94	8.660								2.63E-5									239086294			
Pu427	0.99495	31.414	93.9	11.518	0.09966	3.94	8.310	20	1.1	11.0		21.0			2.51E-5	3.05E-5	3.88E-6	5.09E-5					239086294				
Pu428	0.99472	8.796	98.3	11.518	0.09965	3.97	27.680								2.34E-5									239086294			
Pu429	0.99439	8.825	105.0	11.517	0.09963	3.92	25.800	61	5.9	28.0		50.0			2.19E-5	2.61E-5	5.84E-6	3.64E-5					239086294				
Pu430	0.99403	8.859	113.0	11.515	0.09960	3.92	23.710	50	6.1	23.0		8.10	76.40	45.5	26.8	5.8	2.02E-5	2.15E-5	6.07E-5	3.00E-5	7.25E-4	9.65E-5	2.07E-5	239086294			
Pu431	0.99369	48.446	119.9	11.514	0.09958	3.99	4.770	22	2.6	20.0		5.60	31.40	24.0	32.6	5.1	2.22E-5	5.18E-5	1.42E-5	1.43E-4	2.74E-3	5.46E-5	2.28E-2	239086294			
Pu432	0.99343	48.193	125.4	11.513	0.09956	4.00	4.510	10	1.2	4.3		1.30	11.30	11.8	0.8	1.0	2.09E-5	2.34E-5	6.50E-5	3.06E-5	6.33E-4	7.78E-5	2.67E-5	5.57E-4	4.87E-3	239086294	
Pu433	0.99311	48.343	132.9	11.512	0.09954	3.98	4.060	15	1.7	6.2		1.70	23.90	18.7	34.6	2.1	1.89E-5	9.25E-6	4.43E-5	8.31E-4	1.65E-4	4.25E-5	2.42E-2	1.03E-2	239086294		
Pu434	0.99282	48.286	138.9	11.511	0.09952	4.01	4.060	8.9	1.2	3.4		ND<1	36.00	10.7	33.7	2.1	1.89E-5	6.52E-6	2.42E-5	2.48E-5	2.48E-5	2.48E-5	2.35E-2	1.03E-2	239086294		
Pu435	0.99252	48.395	146.9	11.510	0.09950	4.02	4.110	8.4	1.3	3.1		ND<1	20.10	10.6	35.5	1.5	1.92E-5	7.08E-6	2.22E-5	1.39E-4	2.41E-5	2.48E-5	7.35E-3	239086294			
Pu436	0.99226	48.609	152.9	11.509	0.09948	3.99	4.100	9.2	1.7	3.3		2.30	13.20	9.9	21.4	1.8	1.92E-5	9.31E-6	2.18E-5	1.13E-3	9.18E-5	2.26E-5	1.51E-2	8.86E-3	239086294		
Pu437	0.99147	64.595	168.0	11.506	0.09943	3.95	3.790	12	1.8	11.0		38.90	13.0	9.6	5.1	2.36E-5	3.78E-5	1.31E-5	1.05E-4	3.60E-4	3.96E-5	9.32E-2	3.34E-2	239086294			
Pu438	0.99117	64.176	174.9	11.504	0.09941	3.96	3.127	7.4	1.3	2.5		ND<1	14.90	8.8	36.5	1.9	1.94E-5	2.32E-5	9.42E-6	2.38E-5			1.37E-4	2.66E-5	3.40E-2	1.24E-2	239086294
Pu439	0.99098	64.919	181.9	11.503	0.09939	3.94	2.994	6.6	1.1	2.0		ND<1	13.10	7.6	25.0	1.8	1.88E-5	2.09E-5	8.06E-6	1.92E-5			1.22E-4	2.33E-5	2.35E-2	1.19E-2	239086294
Pu440	0.99058	65.277	188.9	11.502	0.09937	3.92	3.042	7.2	1.3	2.3		ND<1	15.70	8.1	27.5	1.3	1.92E-5	2.30E-5	9.59E-6	2.23E-5			1.47E-4	2.50E-5	2.60E-2	8.62E-3	239086294
Pu441	0.99029	66.031	195.9	11.501	0.09935	3.87	2.890	6.4	1.2	1.9		ND<1	9.50	6.8	21.2	1.6	1.85E-5	2.06E-5	8.96E-5	1.86E-5			9.00E-5	2.12E-5	2.03E-2	1.07E-2	239086294
Pu442	0.99001	64.807	202.9	11.501	0.09933	3.96	2.890	6.8	1.2	1.1		ND<1	18.80	7.2	26.3	1.9	1.81E-5	2.15E-5	9.53E-6	1.92E-5			1.75E-4	2.20E-5	2.48E-2	1.25E-2	239086294
Pu443	0.989845	64.546	207.8	11.494	0.09924	4.02	2.361	4.7	1.3	1.3		ND<1	4.0	4.1	5.74	4.1	1.86E-5	2.41E-5	1.09E-5	1.30E-5			1.29E-5	1.55E-5	2.30E-2	1.24E-2	239086294
Pu444	0.98832	80.743	244.8	11.493	0.09922	4.04	2.361	4.7	1.3	1.3		ND<1	4.8	6.3	16.3	1.8	1.85E-5	1.86E-5	1.19E-5	1.56E-5			1.84E-5	1.86E-5	2.44E-2	1.24E-2	239086294
Pu445	0.98829	80.627	245.8	11.493	0.09922	4.07	2.263	4.9	1.4	1.4		ND<1	4.8	4.1	48.1	1.77E-5	1.94E-5	1.28E-5	1.68E-5			1.76E-5	5.65E-2	2.39086294			
Pu446	0.98824	84.298	246.9	11.493	0.09921	4.05	2.158	4.2	1.2	1.1		ND<1	8.0	2.3	21.1	1.77E-5	1.74E-5	1.15E-5	1.38E-5			1.64E-5	5.10E-2	2.39086294			
Pu447	0.98821	85.036	247.9	11.493	0.09921	4.05	2.083																				

Pu484	0.97375	38.030	624.4	11.437	0.09824	4.11	2.230	5.1	0.9	1.5		3.3	8.44E-6	9.74E-6	3.98E-6	8.70E-6	6.09E-6	239086294
Pu485	0.97312	44.896	657.3	11.434	0.09820	4.01	2.001	4.4	0.9	1.3		3.2	8.95E-6	9.93E-6	4.70E-6	8.91E-6	6.98E-6	239086294
Pu486	0.97272	42.392	679.4	11.433	0.09817	4.06	1.965	4.4	0.9	1.2		3.0	8.30E-6	9.39E-6	4.44E-6	7.77E-6	6.19E-6	239086294
Pu487	0.97215	29.566	715.4	11.430	0.09813	4.11	2.510	6.0	1.2	1.2		3.4	7.40E-6	8.94E-6	4.14E-6	5.43E-6	4.89E-6	239086294
Pu488	0.97147	35.620	756.3	11.428	0.09809	4.02	2.155	5.3	1.1	1.6		3.4	7.67E-6	9.52E-6	4.57E-6	8.73E-6	5.90E-6	239086294
Pu489	0.97094	38.244	790.4	11.426	0.09805	4.11	1.897	4.614	0.777	1.24		3.407	7.25E-6	8.91E-6	3.47E-6	7.27E-6	6.36E-6	239086294
Pu490	0.97056	34.342	814.4	11.424	0.09803	3.88	2.133	7.42	1.037	1.53		3.054	7.33E-6	1.29E-5	4.16E-6	8.06E-6	5.12E-6	239086294
Pu491	0.97022	39.472	833.4	11.423	0.09800	3.94	2.096	4.586	0.605	1.386		2.072	8.29E-6	9.15E-6	2.79E-6	8.40E-6	4.00E-6	239086294
Pu492	0.96962	36.950	874.3	11.420	0.09796	4.05	1.845	3.847	0.486	1		2.282	6.83E-6	7.19E-6	2.10E-6	5.69E-6	4.12E-6	239086294
Pu493	0.96932	33.772	895.4	11.419	0.09794	4.03	1.940	4.427	0.543	1.131		2.338	6.57E-6	7.57E-6	2.15E-6	5.87E-6	3.86E-6	239086294
Pu494	0.96865	36.594	931.4	11.417	0.09790	3.92	2.373	3.948	0.921	0.896		2.236	8.72E-6	7.32E-6	3.95E-6	5.05E-6	4.01E-6	239086294
Pu495	0.96829	37.271	958.4	11.415	0.09787	4.01	1.660	3.99	0.27	1.235		2.05	6.22E-6	7.54E-6	1.18E-6	7.09E-6	3.75E-6	239086294
Pu496	0.96774	42.288	996.4	11.4130	0.0978	4.00	1.597	4.16	0.45	1.041		1.795	6.79E-6	8.93E-6	2.23E-6	6.78E-6	3.72E-6	239086294
Pu497	0.96742	40.448	1023.3	11.4118	0.0978	4.03	1.350	3.27	0.37	1.076		1.626	5.49E-6	6.72E-6	1.76E-6	6.71E-6	3.23E-6	239086294
Pu498	0.96704	24.953	1049.4	11.4103	0.0978	4.06	2.712	5.41	1.21	1.007		2.512	6.81E-6	6.86E-6	3.55E-6	3.88E-6	3.08E-6	239086294
Pu499	0.96612	28.029	1114.9	11.4067	0.0977	4.07	2.330	7.39	1.19	1.9		2.358	6.58E-6	1.05E-5	3.93E-6	8.23E-6	3.25E-6	239086294
Pu500	0.96550	38.083	1163.3	11.4042	0.0977	4.01	1.568	3.42	0.82	1.08		1.27	6.03E-6	6.64E-6	3.68E-6	6.36E-6	2.38E-6	239086294
Pu501	0.96487	32.977	1206.4	11.4018	0.0976	4.01	2.050	3.63	1.14	0.819		1.643	6.83E-6	6.11E-6	4.44E-6	4.18E-6	2.67E-6	239086294
Average	0.97465																	
%loss		2.535																

25 C data	Mass	Ceramics	Flow Rate	Run time	Diameter	Surf. Area	pH	Pu	U	Hf	Gd	Ga	Ca	Tl	Zn	Mg	NR-Pu	NR-U	NR-Hf	NR-Gd	NR-Ga	NR-Ca	NR-Tl	NR-Zn	NR-Mg	#Particles					
ph 6	(g)	(mL/day)	(days)	(microns)	(sq. m)		ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	g/m^2/day														
Pu601	0.99997	14.427	0.4	11.5383	0.1000	5.77	29.920										4.11E-5	0.00E+0	0.00E+0									239086294			
Pu602	0.99991	14.418	1.2	11.5381	0.1000	5.77	20.830	1263	ND<0.5	158.0						1.4	2.86E-5	8.76E-4	3.33E-4									239086294			
Pu603	0.99984	14.319	2.4	11.5379	0.1000	5.91	19.260	673	ND<0.5	172.0						2.0	2.63E-5	4.63E-4	3.60E-4									239086294			
Pu604	0.99981	14.806	3.0	11.5377	0.1000	5.72	17.760										2.47E-5												239086294		
Pu605	0.99968	14.355	5.8	11.5372	0.1000	5.65	15.010										2.05E-5												239086294		
Pu606	0.99959	14.295	7.9	11.5369	0.1000	5.62	13.060										1.78E-5												239086294		
Pu607	0.99952	14.290	9.9	11.5365	0.1000	5.64	11.610										1.58E-5												239086294		
Pu608	0.99943	13.774	12.9	11.5363	0.1000	5.70	10.800										1.42E-5												239086294		
Pu609	0.99934	14.333	15.9	11.5355	0.1000	5.68	9.500										1.30E-5												239086294		
Pu610	0.99923	14.161	19.9	11.5355	0.0999	5.56	8.780										1.19E-5												239086294		
Pu611	0.99916	14.121	22.9	11.5352	0.0999	5.61	8.380										1.13E-5												239086294		
Pu612	0.99906	13.949	26.9	11.5348	0.0999	5.82	7.900										1.05E-5												239086294		
Pu613	0.99899	13.948	29.9	11.5346	0.0999	5.65	7.810	56	ND<0.5	53.0						3.4	1.04E-5	3.76E-5	1.08E-4										239086294		
Pu614	0.99882	13.307	37.9	11.5339	0.0999	5.64	7.210										9.15E-6												239086294		
Pu615	0.99858	23.678	48.9	11.5330	0.0999	5.68	4.570	21	ND<0.5	24.0						2.2	1.01E-5	2.34E-5	8.10E-5										239086294		
Pu616	0.99852	24.332	51.8	11.5328	0.0999	5.56	3.710										8.62E-6												239086294		
Pu617	0.99839	22.269	55.9	11.5323	0.0999	5.70	3.720	16	ND<0.5	28.0						1.3	7.91E-6	1.72E-5	9.13E-5										239086294		
Pu618	0.99828	23.502	58.8	11.5318	0.0999	5.67	3.480										7.81E-6												239086294		
Pu619	0.99821	23.707	62.4	11.5316	0.0999	5.82	3.540	11	ND<0.5	21.0						1.0	8.02E-6	1.26E-5	7.29E-5										239086294		
Pu620	0.99815	23.140	65.8	11.5314	0.0999	5.66	3.460										7.65E-6												239086294		
Pu621	0.99809	21.560	69.9	11.5311	0.0999	5.68	3.440	14	ND<0.5	21.0						1.1	7.09E-6	1.46E-5	6.63E-5										239086294		
Pu622	0.99805	17.999	72.9	11.5309	0.0999	5.75	3.650										6.28E-6												239086294		
Pu623	0.99799	22.845	76.9	11.5307	0.0999	5.75	2.840	10	ND<0.5	21.0						0.9	6.20E-6	1.10E-5	7.03E-5										239086294		
Pu624	0.99789	20.913	83.9	11.5303	0.0999	5.72	3.170										6.34E-6												239086294		
Pu625	0.99785	24.680	86.9	11.5302	0.0999	5.68	2.360	8	ND<0.5	20.0						0.7	5.57E-6	9.53E-6	7.23E-5										239086294		
Pu626	0.99778	31.986	90.9	11.5299	0.0999	5.74	2.540										7.77E-6												239086294		
Pu627	0.99775	31.694	93.9	11.5298	0.0998	5.74	1.680	5.8	ND<0.5	17.0						ND<0.5	5.09E-6	8.87E-6	7.89E-5									239086294			
Pu628	0.99770	9.000	98.3	11.5295	0.0998	5.69	5.290										4.55E-6												239086294		
Pu629	0.99763	8.971	105.0	11.5293	0.0998	5.62	5.570	13	ND<0.5	17.0							4.78E-6	5.63E-6	2.24E-5										239086294		
Pu630	0.99756	8.925	113.0	11.5291	0.0998	5.62	4.540	12	ND<1	16.0						3.80	6.37E-6	5.17E-6	2.09E-5	3.41E-4	1.90E-4	7.53E-7								239086294	
Pu631	0.99750	47.188	119.9	11.5288	0.0998	5.76	0.920	7.9	ND<1	19.0						4.80	141.30	11.0	59.2	11.6	4.15E-6	1.80E-5								239086294	
Pu632	0.99743	45.135	125.4	11.5288	0.0998	5.91	1.190	3.3	ND<1	16.0						ND<3	106.40	1.8	2.2	3.2	5.14E-6	7.19E-6	1.06E-4								239086294
Pu633	0.99735	41.753	132.9	11.5283	0.0998	5.86	1.280	7.4	ND<1	31.0						4.30	227.70	5.2	52.5	10.3	5.11E-6	1.49E-5	1.90E-4	1.80E-3	1.35E-3	1.01E-2	3.15E-2	4.32E-2	239086294		
Pu634	0.99727	40.246	139.9	11.5280	0.0998	5.74	1.280	5.5	ND<1	30.0						3.70	191.80	4.7	54.3	8.8	4.93E-6	1.07E-5	1.77E-4	1.50E-3	1.10E-3	8.83E-4	3.56E-2	3.14E-2	239086294		
Pu635	0.99719	41.205	146.9	11.5277	0.0998	5.72	1.240	4.2	ND<1	23.0						2.40	169.30	7.5	89.5	6.8	4.89E-6	8.36E-6	1.39E-4	9.90E-4	7.44E-4	5.29E-2	2.81E-2	2.05E-2	239086294		
Pu636	0.99713	39.301	152.9	11.5274	0.0998	5.80	1.210	3.7	ND<1	21.0						2.10	157.20	3.3	59.7	5.2	4.55E-6	7.02E-6	1.21E-4	8.77E-4	6.06E-4	3.37E-2	2.05E-2	1.41E-2	239086294		
Pu637	0.99699	58.815	168.0	11.5269	0.0998	5.78	0.770	4.9	ND<1	9.0						3.80	80.30	8.4	52.2	6.4	4.31E-6	1.39E-5	7.73E-5	2.23E-3	6.67E-4	2.30E-2	4.38E-2	3.76E-2	239086294		
Pu638	0.99692	53.580	174.9	11.5266	0.0998	5.84	0.640	2.7	ND<1	12.0						4.0	141.30	7.3	34.3	4.3	4.31E-6	6.39E-6	9.43E-5								239086294
Pu639	0.99685	52.880	181.9	11.5263	0.0998	5.88	0.891	2.8	ND<1	13.0						87.70	2.1	37.9	3.9	4.51E-6	7.16E-6	1.01E-4								239086294	
Pu640	0.99678	50.922	188.9	11.5261	0.0998	5.84	0.852	3.1	ND<1	13.0						ND<3	93.80	1.9	27.2	4.1	4.15E-6	7.63E-6	9.72E-5								239086294
Pu641	0.99671	50.874	195.9	11.5258	0.0998	5.84	0.884	3.1	ND<1	13.0						ND<3	83.60	1.8	30.2	4.7	4.31E-6	7.62E-6	9.71E-5								239086294
Pu642	0.99666	53.077	202.9	11.5256	0.0998	5.96	0.727	2.7	ND<1	15.0						ND<3	109.70	2.4	27.8	4.5	3.70E-6	6.93E-6	1.17E-4								239086294
Pu643	0.99658	48.748	209.9	11.5253	0.0998	5.80	1.088	2.8	ND<1	20.0						ND<3	129.80	2.5	33.0	6.4	5.08E-6	6.60E-6	1.43E-4								239086294
Pu644	0.99650	51.968	216.9	11.5250	0.0998	5.83	0.641	2.2	ND<1	13.0						ND<3	6.4	2.3	30.7	3.78E-6	6.55E-6	1.17E-4								239086294	
Pu645	0.99642	52.414	223.9	11.5247	0.0997	5.98	0.511	1.7	ND<1	6.0						ND															

Appendix B

Ce-U Multi-phase Pyrochlore-based Ceramic Waste Form

Pu Dissolution Project (U-Ce-Ca-Ti-Hf samples)

pH 2-8 : sample ID: P104

Experiments Started on:
7/9/97 11:00 AM

Sample: U-Ce-Ti-Ca Ceramic

Starting SA= 0.1028 m^2/g
 ceramic density 5.3 g/cm^3

5.300E-12 g/μ^3

Element	NtFracElement
U	0.2562
Ce	0.0754
Ca	0.0863
Ti	0.2061
Hf	0.0961

Surface Area Calculation assume spherical particles	
diameter(microns) =	11.01
num.particles/g =	2.70E+08

Formulas for cell entries

Net Rate= Concentration(ppb) * 0.000001 * FlowRate(mL/day) * 0.001/SampleMass(g)/SurfaceArea(m^2/g)/Wt.Fraction

SampleMass= init. wt. - (days elapsed * FlowRate (mL/day) * ((ppbU*U_Wt.Fraction)+(ppbCe*Ce_Wt.Fraction)+...+)*0.000001)

Diameter= 2 * (SampleMass()*.75/n/Density(g/cm.mic.)/#Particles)^(1/3)

Note that Initial Diameter is assumed to be the same for all runs.

Surface Area (m^2/g)= # Particles*4*π*((Diameter(m)/2)^2)/10^-12

Particles= Sample Mass (g) * # Particles/gram

Particles/gram = Surface Area (m^2/g)/(4*π*(Initial Diameter(m)/2)^2)***

**Value of # Particles/g is kept constant through out a run.

Initial Diameter (um): 2^3/SurfaceArea((10^6 μm)^2/g)/Density(g/(10^6 μm)^3)

25 C data	Mass Ceramics	Flow Rate	Run time	Diameter	Surf. Area	pH	U	Ce	Ca	Ti	Hf	NR-U	NR-Ce	NR-Ca	NR-Ti	NR-Hf	#Particles
pH 2	(g)	(mL/day)	(days)	(microns)	(sq. m)												414313321
start	1.5355	0.00	11.012	0.15785	2.19	ppb	ppb	ppb	ppb	ppb	ppb	g/m^2/day	g/m^2/day	g/m^2/day	g/m^2/day	g/m^2/day	414313321
U201	1.5355	19.4402	0.52	11.012	0.15785	2.20	2600.00	9400.00	18800.00	110.00	8.14E-4	1.00E-2	1.75E-2	4.28E-5	4.28E-5	414313321	
U202	1.5355	19.9048	2.13	11.012	0.15785	2.09	790.00	390.00	540.00	310.00	2.53E-4	4.25E-4	5.14E-4	1.24E-4	1.24E-4	414313321	
U203	1.5354	20.2216	5.42	11.012	0.15785	2.14	280.00	170.00	190.00	180.00	9.12E-5	1.88E-4	1.84E-4	7.29E-5	7.29E-5	414313321	
U204	1.5354	20.1965	7.47	11.012	0.15785	2.12	210.00	120.00	140.00	150.00	6.83E-5	1.33E-4	1.35E-4	6.06E-5	6.06E-5	414313321	
U205	1.5354	20.6258	9.13	11.012	0.15785	2.10	180.00	100.00	120.00	130.00	5.98E-5	1.13E-4	1.18E-4	5.37E-5	5.37E-5	414313321	
U206	1.5354	20.3262	12.39	11.012	0.15785	2.14	150.00	80.00	90.00	100.00	4.91E-5	8.89E-5	8.75E-5	4.07E-5	4.07E-5	414313321	
U207	1.5354	21.4172	14.38	11.012	0.15784	2.12	150.00	80.00	90.00	100.00	5.17E-5	9.37E-5	9.22E-5	4.29E-5	4.29E-5	414313321	
U208	1.5354	21.3506	16.15	11.012	0.15784	2.10	119.00	65.00	74.00	118.00	0.030	4.09E-5	7.59E-5	7.55E-5	5.04E-5	2.75E-8	414313321
U209	1.5354	21.7019	19.07	11.012	0.15784	1.98	101.00	53.00	57.00	97.00	0.020	3.53E-5	6.29E-5	5.91E-5	4.21E-5	1.86E-8	414313321
U210	1.5354	21.8524	21.07	11.012	0.15784	2.09	96.00	51.00	63.00	95.00	<0.001	3.38E-5	6.10E-5	6.58E-5	4.16E-5	4.16E-5	414313321
U211	1.5354	22.0952	23.08	11.012	0.15784	2.11	99.00	50.00	50.00	86.00	<0.001	3.52E-5	6.04E-5	5.28E-5	3.80E-5	4.14313321	414313321
U212	1.5354	22.3778	26.07	11.012	0.15784	2.12	83.00	41.00	43.00	73.00	<0.001	2.99E-5	5.02E-5	4.80E-5	3.27E-5	4.14313321	414313321
U213	1.5354	22.6988	29.08	11.012	0.15784	2.11	74.00	37.00	44.00	64.00	0.030	2.71E-5	4.59E-5	4.78E-5	2.91E-5	2.92E-8	414313321
U214	1.5354	22.6155	33.10	11.012	0.15784	2.05	64.00	32.00	50.00	58.00	0.040	2.33E-5	3.96E-5	5.41E-5	2.63E-5	3.88E-8	414313321
U215	1.5354	22.8489	36.06	11.012	0.15784	2.07	64.00	32.00	42.00	58.00	0.010	2.36E-5	4.00E-5	4.59E-5	2.65E-5	9.81E-9	414313321
U216	1.5354	23.0444	40.07	11.012	0.15784	2.18	55.00	26.00	43.00	41.00	0.060	2.04E-5	3.28E-5	4.74E-5	1.89E-5	5.94E-8	414313321
U217	1.5354	23.2304	43.09	11.012	0.15784	2.16	49.00	23.00	34.00	35.00	0.150	1.83E-5	2.92E-5	3.78E-5	1.63E-5	1.50E-7	414313321
U218	1.5354	24.1342	51.11	11.012	0.15784	2.16	52.00	25.00	37.00	39.00	0.030	2.02E-5	3.30E-5	4.27E-5	1.88E-5	3.11E-8	414313321
U219	1.5354	34.0764	62.09	11.012	0.15784	2.24	23.00	11.00	18.00	20.00	0.210	1.26E-5	2.05E-5	2.93E-5	1.36E-5	3.07E-7	414313321
U220	1.5354	34.2141	69.09	11.012	0.15784	2.15	36.00	17.00	28.00	36.00	0.180	1.98E-5	3.18E-5	4.58E-5	2.47E-5	2.64E-7	414313321
U221	1.5354	35.0368	72.04	11.012	0.15784	2.12	28.00	13.00	19.00	27.00	0.180	1.58E-5	2.49E-5	3.18E-5	1.89E-5	2.71E-7	414313321
U222	1.5354	35.8957	75.59	11.012	0.15784	2.14	26.00	12.00	24.00	24.00	0.200	1.50E-5	2.35E-5	4.12E-5	1.72E-5	3.08E-7	414313321
U223	1.5354	36.5991	78.08	11.012	0.15784	2.17	26.00	13.00	25.00	29.00	0.220	1.53E-5	2.60E-5	4.37E-5	2.12E-5	3.46E-7	414313321
U224	1.5354	36.6732	83.08	11.012	0.15784	2.17	24.00	12.00	27.00	27.00	0.230	1.42E-5	2.41E-5	4.73E-5	1.98E-5	3.62E-7	414313321
U225	1.5354	36.8730	86.07	11.012	0.15784	2.14	24.00	12.00	25.00	26.00	0.240	1.43E-5	2.42E-5	4.41E-5	1.92E-5	3.80E-7	414313321
U226	1.5354	38.9504	90.10	11.012	0.15784	2.14	20.00	9.00	29.00	21.00	0.290	1.25E-5	1.92E-5	5.40E-5	1.84E-5	4.85E-7	414313321
U227	1.5354	29.3769	97.58	11.012	0.15784	2.13	25.00	12.00	22.00	21.00	0.180	1.18E-5	1.93E-5	3.09E-5	1.24E-5	2.27E-7	414313321
U228	1.5354	31.4685	100.10	11.012	0.15784	2.21	24.00	11.00	21.00	24.00	0.220	1.22E-5	1.89E-5	3.16E-5	1.51E-5	2.97E-7	414313321
U229	1.5354	31.9484	104.54	11.012	0.15784	2.20	25.00	12.00	19.00	25.00	0.300	1.29E-5	2.10E-5	2.90E-5	1.80E-5	4.12E-7	414313321
U230	1.5354	32.7712	107.12	11.012	0.15784	2.20	23.00	11.00	18.00	24.00	0.210	1.21E-5	1.97E-5	2.82E-5	1.57E-5	2.95E-7	414313321
U231	1.5354	17.9205	111.50	11.012	0.15784	2.18	40.00	19.00	39.00	34.00	0.300	1.15E-5	1.86E-5	3.34E-5	1.22E-5	2.31E-7	414313321
U232	1.5354	15.2762	117.78	11.012	0.15784	2.20	43.00	21.00	28.00	35.00	0.240	1.06E-5	1.75E-5	2.05E-5	1.07E-5	1.57E-7	414313321
U233	1.5354	15.3315	125.74	11.012	0.15784	2.15	40.00	19.00	32.00	34.00	0.310	9.88E-6	1.59E-5	2.35E-5	1.04E-5	2.04E-7	414313321
U234	1.5354	42.5778	134.56	11.012	0.15784	2.07	16.40	6.30	33.00	14.00	1.200	1.12E-5	1.47E-5	6.72E-5	1.19E-5	2.19E-6	414313321
U235	1.5354	42.2044	138.59	11.012	0.15784	2.04	14.90	5.90	11.00	10.00	0.870	1.01E-5	1.38E-5	2.22E-5	8.45E-6	1.58E-6	414313321
U236	1.5354	42.3227	146.12	11.012	0.15784	2.09	13.80	5.60	36.00	9.00	0.730	9.27E-6	1.30E-5	7.29E-5	7.63E-6	1.33E-6	414313321
U237	1.5354	42.5661	153.10	11.012	0.15784	2.14	12.60	5.20	9.00	8.40	0.720	8.64E-6	1.21E-5	1.83E-5	7.16E-6	1.32E-6	414313321
U238	1.5354	43.5513	160.05	11.012	0.15784	2.14	12.00	5.20	11.00	8.40	0.710	8.42E-6	1.24E-5	2.29E-5	7.32E-6	1.33E-6	414313321
U239	1.5354	44.5502	166.09	11.012	0.15784	2.16	11.60	4.80	11.00	7.70	0.670	8.32E-6	1.17E-5	2.34E-5	6.87E-6	1.28E-6	414313321
U240	1.5354	55.0971	181.22	11.012	0.15784	2.08	8.00	3.70	8.00	8.40	0.850	7.10E-6	1.12E-5	2.11E-5	9.27E-6	2.01E-6	414313321
U241	1.5353	56.4611	188.06	11.012	0.15784	2.10	8.30	3.70	7.00	5.80	0.730	7.55E-6	1.14E-5	1.89E-5	8.56E-6	1.77E-6	414313321
U242	1.5353	56.8792	195.08	11.012	0.15784	2.11	8.10	3.30	7.00	7.40	0.520	7.42E-6	1.03E-5	8.43E-6	1.27E-6	1.43E-6	414313321
U243	1.5353	56.8209	202.13	11.012	0.15784	2.08	7.40	3.00	7.20	0.550	6.77E-6	9.33E-6	8.19E-6	1.34E-6	1.43E-6	414313321	

U244	1.5353	60.4980	209.12	11.012	0.15784	2.01	7.80	4.16	7.00	8.60	0.490	7.80E-6	1.38E-5	2.02E-5	1.04E-5	1.27E-6	414313321
U245	1.5353	135.4886	215.05	11.012	0.15784	2.05	7.10	3.76	6.00	6.00	0.340	1.55E-5	2.79E-5	3.89E-5	1.63E-5	1.98E-6	414313321
U246	1.5353	90.9934	217.07	11.012	0.15784	2.10	5.40	2.76	3.00	5.50	0.430	7.91E-6	1.37E-5	1.31E-5	1.00E-5	1.68E-6	414313321
U247	1.5353	91.0660	223.05	11.012	0.15784	2.10	4.70	2.46	2.00	5.00	0.270	6.89E-6	1.23E-5	8.71E-6	9.12E-6	1.08E-6	414313321
U248	1.5353	82.7460	229.59	11.012	0.15784	2.04	3.89	2.00	3.00	3.40	0.310	5.18E-6	9.05E-6	1.19E-5	5.63E-6	1.10E-6	414313321
U249	1.5353	81.5143	237.08	11.012	0.15784	2.10	5.10	2.56		7.90	0.210	6.70E-6	1.14E-5		1.29E-5	7.35E-7	414313321
U250	1.5353	84.7465	250.60	11.012	0.15784	2.09	4.60	2.36		6.30	0.070	6.28E-6	1.09E-5		1.07E-5	2.55E-7	414313321
U251	1.5353	85.5832	257.61	11.012	0.15784	2.09	5.85	2.74		5.70	3.650	8.06E-6	1.28E-5		9.77E-6	1.34E-5	414313321
U252	1.5353	83.5924	264.61	11.012	0.15784	2.09	6.27	2.86		6.20	3.160	8.44E-6	1.31E-5		1.04E-5	1.13E-5	414313321
U253	1.5353	85.7766	271.57	11.012	0.15784	2.10	5.55	2.49		5.60	2.030	7.67E-6	1.17E-5		9.82E-6	7.48E-6	414313321
U254	1.5353	86.3797	280.06	11.012	0.15784	2.10	4.71	2.26		5.40	1.240	6.55E-6	1.07E-5		9.34E-6	4.60E-6	414313321
U255	1.5353	86.9639	285.09	11.012	0.15784	1.95	4.65	2.25	8.00	4.20	1.340	6.51E-6	1.07E-5	3.33E-5	7.31E-6	5.00E-6	414313321
U256	1.5353	87.5639	293.07	11.012	0.15784	1.91	3.97	1.90	6.00	3.60	0.690	5.80E-6	9.10E-6	2.51E-5	6.31E-6	2.59E-6	414313321
U257	1.5353	88.7304	300.11	11.012	0.15784	1.93	3.38	1.76	3.00	3.40	0.380	4.83E-6	8.54E-6	1.27E-5	6.04E-6	1.45E-6	414313321
U258	1.5353	88.0791	306.08	11.012	0.15784	1.94	3.25	1.70	2.00	3.30	0.450	4.61E-6	8.19E-6	8.42E-6	5.82E-6	1.70E-6	414313321
U259	1.5353	88.5035	313.09	11.012	0.15784	1.93	3.00	1.67	14.00	2.90	0.290	4.28E-6	8.09E-6	5.92E-6	5.14E-6	1.10E-6	414313321
U260	1.5353	82.1206	328.34	11.012	0.15784	1.95	3.06	1.77	7.00	3.10	0.370	4.05E-6	7.95E-6	2.75E-5	5.10E-6	1.30E-6	414313321
U261	1.5353	76.1297	334.28	11.012	0.15784	1.94	3.31	1.95	32.00	3.20	0.320	4.06E-6	8.12E-6	1.16E-4	4.88E-6	1.05E-6	414313321
U262	1.5353	85.1260	348.42	11.012	0.15784	1.92	2.43	1.58	10.00	2.28	0.326	3.33E-6	7.36E-6	4.07E-5	3.89E-6	1.19E-6	414313321
U263	1.5353	86.7937	355.40	11.012	0.15784	1.94	2.37	1.54	26.00	2.19	0.245	3.31E-6	7.31E-6	1.08E-4	3.81E-6	9.13E-7	414313321
U264	1.5353	85.7758	362.40	11.012	0.15784	1.99	2.29	1.52	10.00	2.10	0.255	3.16E-6	7.13E-6	4.10E-5	3.61E-6	9.39E-7	414313321
U265	1.5353	84.6300	371.38	11.012	0.15784	1.98	2.55	1.67	19.00	2.30	0.240	3.48E-6	7.73E-6	7.69E-5	3.90E-6	8.72E-7	414313321
U266	1.5353	84.0665	377.89	11.012	0.15784	1.96	2.05	1.45	1.00	2.03	0.251	2.78E-6	6.67E-6	4.02E-6	3.42E-6	9.06E-7	414313321
U267	1.5353	86.9514	384.91	11.012	0.15784	2.28	1.95	1.39	6.00	1.90	0.245	2.73E-6	6.61E-6	2.49E-5	3.31E-6	9.15E-7	414313321
U268	1.5353	66.3467	392.88	11.012	0.15782	2.47	4.389	1.943		1.542	0.087	4.69E-6	7.05E-6		2.05E-6	2.48E-7	414259552
U269	1.5353	48.2027	404.86	11.012	0.15782	2.87										414259552	
U270	1.5353	47.6917	418.86	11.012	0.15782	2.65	3.142	1.895		1.721	0.084	2.41E-6	4.94E-6		1.64E-6	1.31E-7	414259552
U271	1.5353	46.2770	432.92	11.012	0.15782	1.96											414259552
U272	1.5353	46.0795	447.90	11.012	0.15782	1.96	3.109	2.018		2.763	0.208	2.31E-6	5.09E-6		2.55E-6	4.08E-7	414259552
U273	1.5353	46.2570	460.94	11.012	0.15782	1.92											414259552
U274	1.5353	46.5480	474.91	11.012	0.15782	1.96	2.887	1.799		2.573	0.232	2.16E-6	4.58E-6		2.40E-6	4.64E-7	414259552
U275	1.5353	45.6937	490.84	11.012	0.15782	1.94											414259552
U276	1.5353	45.0787	498.89	11.012	0.15782	1.95	2.631	1.62		2.552	0.226	1.91E-6	4.00E-6		2.30E-6	4.38E-7	414259552
U277	1.5353	43.1519	510.91	11.012	0.15782	1.92											414259552
U278	1.5353	43.6246	516.89	11.012	0.15781	1.93	2.31	1.65		2.00	0.230	1.82E-6	3.94E-6		1.75E-6	4.31E-7	414259552
U279	1.5353	43.1228	524.89	11.012	0.15781	2.01											414259552
U280	1.5353	42.4494	544.98	11.012	0.15781	1.98	2.50	1.77		2.19	0.280	1.71E-6	4.11E-6		1.86E-6	5.10E-7	414259552
U281	1.5353	42.1120	568.89	11.012	0.15781	1.95	2.44	1.81		2.14	0.270	1.66E-6	4.17E-6		1.80E-6	4.88E-7	414259552
U282	1.5353	44.4481	588.88	11.012	0.15781	1.95	2.21	1.57		1.86	0.250	1.58E-6	3.82E-6		1.66E-6	4.77E-7	414259552
U283	1.5353	43.1887	615.90	11.012	0.15781	1.97	2.23	1.57		1.82	0.300	1.55E-6	3.71E-6		1.57E-6	5.56E-7	414259552
U284	1.5353	42.9304	637.91	11.012	0.15781	1.97	2.05	1.52		1.84	0.270	1.42E-6	3.57E-6		1.58E-6	4.98E-7	414259552
U285	1.5353	44.5630	670.84	11.012	0.15781	1.95	1.93	1.41		1.72	0.280	1.39E-6	3.44E-6		1.53E-6	4.98E-7	414259552
U286	1.5353	43.8650	692.92	11.012	0.15781	1.97	1.91	1.43		1.96	0.300	1.34E-6	3.42E-6		1.71E-6	5.63E-7	414259552
U287	1.5353	45.1960	728.88	11.012	0.15781	1.96	1.75	1.30		1.51	0.360	1.27E-6	3.21E-6		1.37E-6	5.99E-7	414259552
U288	1.5353	47.7036	769.77	11.012	0.15781	1.87	1.52	1.16		1.38	0.360	1.17E-6	3.03E-6		1.32E-6	7.38E-7	414259552
U289	1.5353	51.8343	803.92	11.012	0.15781	1.98	1.27	0.98		1.16	1.300	1.06E-6	2.77E-6		1.20E-6	2.88E-6	414259552
U290	1.5353	50.0321	827.83	11.012	0.15781	2.04	1.34	0.94		1.24	0.747	1.08E-6	2.58E-6		1.24E-6	1.81E-6	414259552
U291	1.5353	51.4092	846.89	11.012	0.15781	2.08	1.42	0.98		1.31	0.570	1.17E-6	2.77E-6		1.35E-6	1.26E-6	414259552
U292	1.5353	49.2797	887.76	11.012	0.15781	2.20	1.20	0.88		1.12	0.240	9.51E-7	2.38E-6		1.11E-6	5.08E-7	414259552
U293	1.5353	48.5871	908.91	11.012	0.15781	2.07	1.21	0.91		1.08	0.148	9.45E-7	2.42E-6		1.05E-6	3.09E-7	414259552
U294	1.5353	60.3662	944.87	11.012	0.15781	2.10	1.14	0.88		1.06	0.514	1.11E-6	2.89E-6		1.28E-6	1.33E-6	414259552
U295	1.5353	50.5136	971.90	11.012	0.15781	2.03	1.14	0.79		0.95	0.29	9.28E-7	2.18E-6		9.58E-7	6.29E-7	414259552
U296	1.5353	55.9385	1009.86	11.012	0.15781	2.03	1.14	0.91		0.93	0.27	1.03E-6	2.78E-6		1.04E-6	6.49E-7	414259552
U297	1.5353	42.0899	1036.82	11.012	0.15781	2.05	0.99	5.50		8.35	0.21	6.10E-8	1.27E-5		7.03E-6	3.80E-7	414259552
U298	1.5353	55.9068	1082.87	11.012	0.15781	2.04	1.72	1.11		1.02	0.24	1.55E-6	3.39E-6		1.14E-6	5.78E-7	414259552
U299	1.5353	49.3703	1128.43	11.012	0.15781	2.04	1.18	0.89		0.96	0.11	9.39E-7	2.39E-6		9.51E-7	2.33E-7	414259552
U2100	1.5353	41.9573	1178.79	11.012	0.15781	2.02	1.20	0.96		0.92	0.20	8.11E-7	2.21E-6		7.70E-7	3.60E-7	414259552
U2101	1.5353	38.9008	1219.83	11.012	0.15782	2.05	1.27	0.86		0.81	0.06	7.96E-7	1.82E-6		6.28E-7	1.00E-7	414259552
average	1.5353					2.08						0.00E+0	0.00E+0		0.00E+0	0.00E+0	

25 C data	Mass Ceramics	Flow Rate	Run time	Diameter	Surf. Area	pH	U	Ce	Ca	Ti	Hf	NR-U	NR-Ce	NR-Ca	NR-Ti	NR-Hf	#Particles	
		(g)	(mL/day)	(days)	(microns)	(sq. m)	ppb	ppb	ppb	ppb	ppb	g/m^2/day	g/m^2/day	g/m^2/day	g/m^2/day	g/m^2/day		
pH 4																		
start	1.8457	1.8457	19.3578	0.52	11.012	0.18974	4.05	960.00	1060.00	1260.00	3.00	2.07E-4	7.77E-4	8.07E-4	8.05E-7	4.98012437	4.98012437	
U401	1.8457	19.4396	2.13	11.012	0.18974	4.39	140.00	1024.00	920.00	1.00	3.03E-5	7.54E-4	5.92E-4	2.69E-7	4.98012437	4.98012437		
U402	1.8457	19.4835	5.42	11.012	0.18974	4.14	96.00	920.00	780.00	1.00	2.08E-5	6.79E-4	5.03E-4	2.70E-7	4.98012437	4.98012437		
U403	1.8457	19.3446	7.47	11.012	0.18974	4.07	93.00	750.00	750.00	2.00	2.01E-5	5.49E-4	4.80E-4	5.38E-7	4.98012437	4.98012437		
U404	1.8457	19.6170	9.13	11.012	0.18974	4.08	82.00	570.00	480.00	3.00	1.79E-5	4.23E-4	3.12E-4	8.15E-7	4.98012437	4.98012437		
U405	1.8457	19.3256	12.39	11.012	0.18974	4.10	75.00	380.00	300.00	4.00	1.62E-5	2.78E-4	1.92E-4	1.07E-6	4.98012437	4.98012437		
U406	1.8457	19.8100	14.38	11.012	0.18974	4.11	82.00	333.00	677.00	6.10	0.090	1.81E-5	2.50E-4	4.44E-4	1.67E-6	5.30E-8	4.98012437	
U407	1.8457	20.0000	16.15	11.012	0.18974	4.02	87.00	310.00	626.00	7.60	0.040	1.94E-5	2.35E-4	4.14E-4	2.11E-6	2.38E-8	4.98012437	
U408	1.8457	20.2200	19.07	11.012	0.18973	3.92	79.00	226.00	443.00	7.80	0.010	1.78E-5	1.73E-4	2.96E-4	2.19E-6	6.01E-9	4.98012437	
U409	1.8457	20.3500	21.07	11.012	0.18973	4.00	76.00	179.00	352.00	7.60	<0.01	1.72E-5	1.38E-4	2.37E-4	2.14E-6	4.98012437	4.98012437	
U410	1.8456	20.4300	23.08	11.012	0.18973	4.03	82.00	154.00	285.00	8.50	<0.01	1.87E-5	1.19E-4	1.93E-4	2.41E-6	4.98012437	4.98012437	
U411	1.8456	20.1200	26.07	11.012	0.18973	4.04	79.00	116.00	211.00	9.20	<0.01	1.77E-5	8.84E-5	1.40E-4	2.58E-6	4.98012437	4.98012437	
U412	1.8456	20.8065	29.08	11.012	0.18973	4.01	65.00	78.00	138.00	8.30	0.030	1.51E-5	6.14E-5	9.50E-5	2.39E-6	1.85E-8	4.98012437	
U413	1.8456	20.6924	33.10	11.012	0.18973	3.99	57.00	66.00	14.60	10.10	0.030	1.31E-5	5.17E-5	1.00E-5	2.90E-6	1.84E-8	4.98012437	
U414	1.8456	20.8363	36.06	11.012	0.18973	4.00	48.00	19.00	70.00	9.60	0.010	1.11E-5	1.50E-5	4.83E-5	2.77E-6	8.19E-9	4.98012437	
U415	1.8456	20.9800	40.07	11.012	0.18973	4.00	42.00	29.00	52.00	6.60	0.040	9.82E-6	2.30E-5	3.61E-5	1.92E-6	2.49E-8	4.98012437	
U416	1.8456	20.9800	43.09	11.012	0.18973	4.01	36.00	26.00	52.00	7.40	0.060	8.42E-6	2.07E-5	3.81E-5	2.15E-6	3.74E-8	4.98012437	
U417	1.8456	20.8925	51.11	11.012	0.18973	4.06	37.00	25.00	44.00	7.60	0.020	8.62E-6	1.98E-5	3.04E-5	2.20E-6	1.24E-8	4.98012437	
U418	1.8456	23.2320	62.09	11.012	0.18973	4.07	29.00	19.00	38.00	6.80	0.020	7.51E-6	1.87E-5	2.92E-5	2.19E-6	1.38E-8	4.98012437	
U419	1.8456	29.9183	69.09	11.012	0.18973	4.01	18.00	11.00	18.00	5.40	0.010	6.00E-6	1.25E-5	1.78E-5	2.24E-6	8.89E-9	4.98012437	
U420	1.8456	30.8145	72.04	11.012	0.18973	4.00	17.00	10.00	15.00	4.60	<0.01	5.84E-6	1.17E-5	1.53E-5	1.96E-6	4.98012437	4.98012437	
U421	1.8456	31.6039	75.59	11.012	0.18973	4.07	16.00	9.00	11.00	4.30	0.020	5.64E-6	1.08E-5	1.15E-5	1.88E-6	1.88E-8	4.98012437	
U422	1.8456	31.3795	79.08	11.012	0.18973	4.03	15.00	9.00	16.00	5.10	0.020	5.25E-6	1.07E-5	1.66E-5	2.22E-6	1.86E-8	4.98012437	
U423	1.8456	31.5940	83.08	11.012	0.18973	4.00	14.00	8.00	13.00	5.20	0.020	4.93E-6	9.57E-6	1.36E-5	2.28E-6	1.88E-8	4.98012437	
U424	1.8456	31.5808	86.07	11.012	0.18973	4.00	14.00	8.00	17.00	5.10	0.030	4.93E-6	9.56E-6	1.78E-5	2.23E-6	2.82E-8	4.98012437	
U425	1.8456	29.0449	90.10	11.012	0.18973	4.01	15.00	8.00	14.00	5.10	0.020	4.86E-6	8.80E-6	1.35E-5	2.05E-6	1.73E-8	4.98012437	
U426	1.8456	27.4590	97.58	11.012	0.18973	4.03	16.00	8.00	14.00	5.20	0.020	4.90E-6	8.32E-6	1.27E-5	1.98E-6	1.63E-8	4.98012437	
U427	1.8456	19.5846	100.10	11.012	0.18973	3.98	17.00	9.00	17.00	5.40	0.030	3.71E-6	6.87E-6	1.10E-5	1.47E-6	1.75E-8	4.98012437	
U428	1.8456	28.4596	104.54	11.012	0.18973	4.00	13.00	7.00	11.00	4.40	0.030	4.12E-6	7.54E-6	1.04E-5	1.74E-6	2.54E-8	4.98012437	
U429	1.8456	28.9247	107.12	11.012	0.18973	4.00	13.00	7.00	12.00	4.20	0.030	4.19E-6	7.67E-6	1.15E-5	1.68E-6	2.58E-8	4.98012437	
U430	1.8456	15.7118	111.50	11.012	0.18973	4.03	21.00	10.00	18.00	4.80	0.020	3.68E-6	5.95E-6	9.38E-6	1.00E-6	9.34E-9	4.98012437	
U431	1.8456	13.3217	117.78	11.012	0.18973	3.98	23.00	12.00	18.00	5.20	0.030	3.42E-6	6.05E-6	7.93E-6	9.60E-7	1.19E-8	4.98012437	
U432	1.8456	12.8753	125.74	11.012	0.18973	4.05	20.00	12.00	26.00	5.70	0.030	2.87E-6	5.85E-6	1.11E-5	1.02E-6	1.15E-8	4.98012437	
U433	1.8456	36.6927	134.56	11.012	0.18973	4.02	8.40	5.90	23.00	4.40	0.060	3.44E-6	8.20E-6	2.79E-5	2.24E-6	6.54E-8	4.98012437	
U434	1.8456	35.9246	138.59	11.012	0.18973	4.01	7.20	3.10	15.00	3.30	<0.05	2.88E-6	4.22E-6	1.78E-5	1.64E-6	4.98012437	4.98012437	
U435	1.8456	35.2449	146.12	11.012	0.18973	4.00	6.50	3.00	20.00	3.20	<0.5	2.55E-6	4.00E-6	2.33E-5	1.56E-6	4.98012437	4.98012437	
U436	1.8456	34.1230	153.10	11.012	0.18973	4.01	6.00	2.80	10.00	3.20	<0.5	2.28E-6	3.62E-6	1.13E-5	1.51E-6	4.98012437	4.98012437	
U437	1.8456	36.4262	160.05	11.012	0.18973	4.02	6.10	3.10	16.00	3.20	<0.5	2.48E-6	4.28E-6	1.93E-5	1.62E-6	4.98012437	4.98012437	
U438	1.8456	35.6321	166.09	11.012	0.18973	3.99	5.50	2.80	21.00	2.80	<0.5	2.18E-6	3.78E-6	2.48E-5	1.38E-6	4.98012437	4.98012437	
U439	1.8456	44.4187	181.22	11.012	0.18973	4.01	5.50	4.10	12.00	4.00	<0.5	2.72E-6	6.89E-6	1.78E-5	2.46E-6	4.98012437	4.98012437	
U440	1.8456	44.2989	188.06	11.012	0.18973	4.05	3.80	2.10	10.00	2.60	<0.5	1.88E-6	3.52E-6	1.47E-5	1.80E-6	4.98012437	4.98012437	
U441	1.8456	42.8090	195.08	11.012	0.18973	4.01	3.50	2.10		2.60	0.060	1.67E-6	3.40E-6	0.00E+0	1.54E-6	7.63E-8	4.98012437	
U442	1.8456	38.6203	202.13	11.012	0.18973	4.01	3.40	2.10		2.40	0.070	1.46E-6	3.07E-6	0.00E+0	1.28E-6	8.03E-8	4.98012437	
U443	1.8456	35.1425	209.12	11.012	0.18973	3.99	4.60	3.30	11.00		0.110	1.80E-6	4.39E-6	1.28E-5	0.00E+0	1.15E-7	4.98012437	4.98012437
U444	1.8456	92.8658	215.05	11.012	0.18973	4.04	1.60	2.60	46.00		0.080	1.66E-6	9.14E-6	1.41E-4	0.00E+0	2.21E-7	4.98012437	4.98012437
U445	1.8456	86.2583	217.07	11.012	0.18973	4.04	1.60	1.10	5.00		0.070	1.54E-6	3.59E-6	1.43E-5	0.00E+0	1.79E-7	4.98012437	4.98012437
U446	1.8456	83.2990	223.05	11.012	0.18973	4.05	1.70	1.20	4.00		0.040	1.58E-6	3.78E-6	1.10E-5	0.00E+0	9.90E-8	4.98012437	4.98012437
U447	1.8456	80.0236	229.59	11.012	0.18973	4.01	1.69	1.08	4.00		<0.05	1.51E-6	3.27E-6	1.06E-5	0.00E+0	4.98012437	4.98012437	
U448	1.8456	81.5938	237.08	11.012	0.18973	4.03	1.70	1.30			0.130	1.55E-6	4.02E-6	0.00E+0	0.00E+0	3.15E-7	4.98012437	4.98012437
U449	1.8456	81.7441	250.60	11.012	0.18973	4.01	1.70	1.10			0.100	1.55E-6	3.40E-6	0.00E+0	0.00E+0	2.43E-7	4.98012437	4.98012437
U450	1.8456	82.2835	257.61	11.012	0.18973	4.01	1.75	1.13			0.170	1.310	1.81E-6	3.52E-6	0.00E+0	1.94E-6	7.58E-7	4.98012437
U451	1.8456	81.2978	264.61	11.012	0.18973	4												

U459	1.8456	85.4130	313.09	11.012	0.18973	3.90	1.28	0.91	9.00	1.10	0.280	1.22E-6	2.94E-6	2.54E-5	1.30E-6	6.60E-7	498012437
U460	1.8456	84.7285	328.34	11.012	0.18973	3.93	2.51	0.92	9.00	1.10	0.350	2.37E-6	2.95E-6	2.52E-5	1.29E-6	8.81E-7	498012437
U461	1.8456	85.0193	334.28	11.012	0.18973	3.94	1.27	0.95	23.00	1.10	0.320	1.20E-6	3.06E-6	6.47E-5	1.30E-6	8.08E-7	498012437
U462	1.8456	86.9824	348.42	11.012	0.18973	3.94	1.25	0.93	10.00	1.28	0.281	1.21E-6	3.06E-6	2.88E-5	1.54E-6	7.26E-7	498012437
U463	1.8456	88.4728	355.40	11.012	0.18973	3.96	1.20	0.93	19.00	1.31	0.253	1.18E-6	3.12E-6	5.56E-5	1.61E-6	6.65E-7	498012437
U464	1.8456	86.3768	362.40	11.012	0.18973	4.00	1.17	0.9	20.00	1.26	0.214	1.13E-6	2.94E-6	5.72E-6	1.51E-6	5.49E-7	498012437
U465	1.8456	87.1187	371.38	11.012	0.18973	3.94	1.30	0.89		1.25	0.242	1.26E-6	2.94E-6		1.51E-6	6.27E-7	498012437
U466	1.8456	85.4878	377.89	11.012	0.18973	3.94	1.08	0.92		1.28	0.214	1.03E-6	2.98E-6		1.52E-6	5.44E-7	498012437
U467	1.8456	85.9678	384.91	11.012	0.18973	4.01	1.05	0.88		1.28	0.170	1.01E-6	2.86E-6		1.52E-6	4.34E-7	498012437
U468	1.8456	67.5095	392.88	11.012	0.18973	4.15	3.03	1.207		0.54	0.043	2.28E-6	3.09E-6		5.04E-7	8.63E-8	498012437
U469	1.8456	48.4526	404.86	11.012	0.18973	4.22											498012437
U470	1.8456	47.6884	418.86	11.012	0.18973	4.17	1.77	0.965		0.60	0.031	9.38E-7	1.74E-6		3.96E-7	4.39E-8	498012437
U471	1.8456	46.4427	432.92	11.012	0.18973	4.20											498012437
U472	1.8456	46.3562	447.90	11.012	0.18973	4.23	1.37	0.932		0.58	0.023	7.05E-7	1.64E-6		3.75E-7	3.17E-8	498012437
U473	1.8456	46.5983	460.94	11.012	0.18973	4.02											498012437
U474	1.8456	46.9574	474.91	11.012	0.18973	4.01	1.15	0.876		0.78	0.014	6.04E-7	1.56E-6		5.07E-7	1.95E-8	498012437
U475	1.8456	46.5268	490.84	11.012	0.18973	4.04											498012437
U476	1.8456	46.3779	498.89	11.012	0.18973	3.96	0.98	0.797		0.75	0.012	5.05E-7	1.40E-6		4.81E-7	1.65E-8	498012437
U477	1.8456	46.0522	510.91	11.012	0.18973	3.94											498012437
U478	1.8456	45.1130	516.89	11.012	0.18973	3.93	0.87	0.79		0.64	0.021	4.37E-7	1.35E-6		4.00E-7	2.82E-8	498012437
U479	1.8456	46.2902	524.89	11.012	0.18973	4.00											498012437
U480	1.8456	45.4459	544.98	11.012	0.18973	3.99	0.96	0.82		0.62	0.019	4.88E-7	1.41E-6		3.90E-7	2.57E-8	498012437
U481	1.8456	45.0570	568.89	11.012	0.18973	3.97	0.88	0.79		0.60	0.019	4.42E-7	1.35E-6		3.75E-7	2.54E-8	498012437
U482	1.8456	45.8537	588.88	11.012	0.18973	3.97	0.86	0.77		0.57	0.026	4.40E-7	1.34E-6		3.62E-7	3.54E-8	498012437
U483	1.8456	45.5069	615.90	11.012	0.18973	3.99	0.85	0.76		0.59	0.016	4.31E-7	1.31E-6		3.72E-7	2.16E-8	498012437
U484	1.8456	43.8154	637.91	11.012	0.18973	4.08	0.87	0.73		0.48	0.015	4.25E-7	1.21E-6		2.91E-7	1.95E-8	498012437
U485	1.8456	44.4916	670.84	11.012	0.18973	4.00	0.87	0.89		0.58	0.027	4.31E-7	1.50E-6		3.58E-7	3.57E-8	498012437
U486	1.8456	45.7119	692.92	11.012	0.18973	4.01	0.82	0.73		0.55	0.014	4.18E-7	1.26E-6		3.48E-7	1.90E-8	498012437
U487	1.8456	44.7471	728.88	11.012	0.18973	3.96	0.83	0.73		0.62	0.024	4.14E-7	1.24E-6		3.84E-7	3.19E-8	498012437
U488	1.8456	41.9959	769.77	11.012	0.18973	3.88	0.84	0.7		0.61	0.031	3.93E-7	1.11E-6		3.55E-7	3.87E-8	498012437
U489	1.8456	47.4674	803.92	11.012	0.18973	3.96	0.71	0.59		0.54	0.025	3.76E-7	1.06E-6		3.55E-7	3.53E-8	498012437
U490	1.8456	43.0322	827.93	11.012	0.18973	4.04	0.78	0.52		0.58	0.059	3.73E-7	8.47E-7		3.45E-7	7.54E-8	498012437
U491	1.8456	47.1245	846.89	11.012	0.18973	4.04	0.92	0.527		0.45	0.049	4.81E-7	9.40E-7		2.93E-7	6.86E-8	498012437
U492	1.8456	44.7689	887.76	11.012	0.18973	4.06	0.72	0.479		0.44	0.026	3.61E-7	8.12E-7		2.75E-7	3.46E-8	498012437
U493	1.8456	42.9054	908.91	11.012	0.18973	4.00	0.69	0.445		0.47	0.029	3.28E-7	7.23E-7		2.80E-7	3.70E-8	498012437
U494	1.8456	39.7737	944.87	11.012	0.18973	4.24	0.73	0.453		0.53	0.026	3.25E-7	6.82E-7		2.94E-7	3.07E-8	498012437
U495	1.8456	34.3758	971.90	11.012	0.18973	4.02	0.83	0.573		0.48	0.030	3.18E-7	7.46E-7		2.28E-7	3.06E-8	498012437
U496	1.8456	34.0195	1009.86	11.012	0.18973	4.05	0.92	0.597		0.49	0.020	3.49E-7	7.69E-7		2.33E-7	2.02E-8	498012437
U497	1.8456	32.0788	1036.82	11.012	0.18973	4.07	0.00	9.127		1.40	0.030	0.00E+0	1.11E-5		6.24E-7	2.88E-8	498012437
U498	1.8456	27.9601	1062.87	11.012	0.18973	4.10	1.06	0.714		0.57	0.030	3.30E-7	7.56E-7		2.19E-7	2.49E-8	498012437
U499	1.8456	1128.43	11.012	0.18973													498012437
U500	1.8456	42.1705	1176.79	11.012	0.18973	4.04	1.53	1.127		0.66	0.050	7.19E-7	1.80E-6		3.88E-7	6.27E-8	498012437
U501	1.8456	38.5466	1219.83	11.012	0.18973	4.05	2.22	0.543		0.53	0.040	9.54E-7	7.92E-7		2.81E-7	4.58E-8	498012437
average	1.8456					4.02											
% loss	0.0062																

25 C data	Mass Ceramics	Flow Rate	Run time	Diameter	Surf. Area	pH	U	Ce	Ca	Ti	Hf	NR-U	NR-Ce	NR-Ca	NR-Ti	NR-Hf	#Particles
		(g)	(mL/day)	(days)	(microns)	(sq. m)	ppb	ppb	ppb	ppb	ppb	g/m^2/day	g/m^2/day	g/m^2/day	g/m^2/day	g/m^2/day	
U601	1.7973	19.0545	0.52	11.0124	0.1848	6.33	650.00	76.00	7110.00	<0.1	nd	1.46E-4	5.78E-5	4.73E-3			484953001
U602	1.7973	19.8362	2.13	11.0124	0.1848	5.88	240.00	80.00	190.00	<0.1	nd	5.60E-5	6.34E-5	1.32E-4			484953001
U603	1.7973	20.1933	5.42	11.0124	0.1848	5.97	91.00	52.00	89.00	<0.1	nd	2.16E-5	4.19E-5	6.27E-5			484953001
U604	1.7973	20.1304	7.47	11.0124	0.1848	5.96	59.00	47.00	77.00	<0.1	nd	1.40E-5	3.78E-5	5.41E-5			484953001
U605	1.7973	20.1336	9.13	11.0124	0.1848	5.92	46.00	44.00	75.00	<0.1	nd	1.09E-5	3.54E-5	5.27E-5			484953001
U606	1.7973	19.6933	12.39	11.0124	0.1848	5.99	32.00	36.00	61.00	<0.1	nd	7.41E-6	2.83E-5	4.19E-5			484953001
U607	1.7973	19.9500	14.38	11.0124	0.1848	5.98	32.00	36.00	61.00	<0.1	nd	7.50E-6	2.87E-5	4.25E-5			484953001
U608	1.7973	19.9800	16.15	11.0124	0.1848	5.84	29.00	33.00	211.00	0.20	<0.01	6.81E-6	2.63E-5	1.47E-4	5.84E-8		484953001
U609	1.7973	19.9298	19.07	11.0124	0.1848	5.85	22.70	37.00	99.00	0.20	<0.01	5.32E-6	2.94E-5	6.88E-5	5.82E-8		484953001
U610	1.7973	20.0832	21.07	11.0124	0.1848	5.88	20.30	38.00	101.00	0.20	<0.01	4.79E-6	3.05E-5	7.08E-5	5.87E-8		484953001
U611	1.7973	20.0096	23.08	11.0124	0.1848	5.92	12.50	26.00	71.00	0.10	<0.01	2.94E-6	2.08E-5	4.96E-5			484953001
U612	1.7973	19.0302	26.07	11.0124	0.1848	5.93	7.80	15.00	41.00	<0.1	<0.01	1.74E-6	1.14E-5	2.72E-5			484953001
U613	1.7973	19.1176	29.08	11.0124	0.1848	5.87	15.10	33.00	86.00	0.20	<0.01	3.39E-6	2.52E-5	5.74E-5	5.59E-8		484953001
U614	1.7973	18.8207	33.10	11.0124	0.1848	5.86	10.70	32.00	86.00	0.20	<0.01	2.37E-6	2.40E-5	5.65E-5	5.50E-8		484953001
U615	1.7973	19.1900	36.08	11.0124	0.1848	5.90	7.90	27.00	65.00	0.10	<0.01	1.78E-6	2.07E-5	4.35E-5	2.80E-8		484953001
U616	1.7973	18.7120	40.07	11.0124	0.1848	5.85	5.50	21.00	48.00	<0.1	<0.01	1.21E-6	1.57E-5	3.13E-5			484953001
U617	1.7973	18.7218	43.09	11.0124	0.1848	5.86	10.90	46.00	115.00	0.20	0.010	2.40E-6	3.44E-5	7.51E-5	5.47E-8	5.87E-9	484953001
U618	1.7973	18.9696	51.11	11.0124	0.1848	5.84	5.40	22.00	53.00	0.10	<0.01	1.20E-6	1.87E-5	3.51E-5	2.77E-8		484953001
U619	1.7973	18.1843	62.09	11.0124	0.1848	5.86	2.50	37.00	85.00	0.20	<0.01	5.34E-7	2.68E-5	5.39E-5	5.31E-8		484953001
U620	1.7973	31.8792	69.09	11.0123	0.1848	5.84	4.30	39.00	92.00	0.10	<0.01	1.81E-6	4.98E-5	1.02E-4	4.68E-8		484953001
U621	1.7973	31.2567	72.04	11.0123	0.1848	5.84	3.80	38.00	83.00	0.20	<0.01	1.40E-6	4.74E-5	1.01E-4	9.13E-8		484953001
U622	1.7973	33.3622	75.59	11.0123	0.1848	5.93	3.40	38.00	85.00	0.10	0.010	1.33E-6	5.06E-5	9.90E-5	4.87E-8	1.05E-8	484953001
U623	1.7973	30.7530	79.08	11.0123	0.1848	5.87	3.40	38.00	86.00	0.10	<0.01	1.23E-6	4.87E-6	9.23E-5	4.49E-8		484953001
U624	1.7973	29.7017	83.08	11.0123	0.1848	5.85	3.40	40.00	84.00	<0.1	0.010	1.19E-6	4.74E-5	8.71E-5		9.31E-9	484953001
U625	1.7973	31.10350	86.07	11.0123	0.1848	5.87	3.50	23.00	94.00	0.10	<0.01	1.28E-6	2.86E-5	1.02E-4	4.54E-8		484953001
U626	1.7973	32.57280	90.10	11.0123	0.1848	5.87	3.40	44.00	95.00	<0.1	<0.01	1.30E-6	5.72E-5	1.08E-4			484953001
U627	1.7973	24.0522	97.58	11.0123	0.1848	5.91	5.30	41.00	87.00	0.10	<0.01	1.50E-6	3.94E-5	7.30E-5	3.51E-8		484953001
U628	1.7973	23.6227	100.10	11.0123	0.1848	5.86	3.90	44.00	105.00	0.20	<0.01	1.08E-6	4.15E-5	8.86E-5	8.90E-8		484953001
U629	1.7973	30.6691	104.54	11.0123	0.1848	5.83	3.10	44.00	94.00	0.20	<0.01	1.12E-6	5.39E-5	1.01E-4	8.96E-8		484953001
U630	1.7973	31.0570	107.12	11.0123	0.1848	5.83	2.90	46.00	105.00	0.20	<0.01	1.06E-6	5.70E-5	1.14E-4	9.08E-8		484953001
U631	1.7973	17.2464	111.50	11.0123	0.1848	5.90	3.80	50.00	112.00	<0.1	0.010	7.70E-7	3.44E-5	6.74E-5		5.40E-9	484953001
U632	1.7973	14.9164	117.78	11.0123	0.1848	5.82	4.50	48.00	102.00	0.10	0.010	7.89E-7	2.88E-5	5.31E-5	2.18E-8	4.67E-9	484953001
U633	1.7973	15.0861	125.74	11.0123	0.1848	5.86	4.00	43.00	86.00	0.10	0.020	7.09E-7	2.59E-5	4.53E-5	2.20E-8	9.46E-9	484953001
U634	1.7972	41.1114	134.56	11.0123	0.1848	5.89	2.80	52.00	248.00	0.070	1.35E-6	8.54E-5	3.56E-4	0.00E+0	9.02E-8		484953001
U635	1.7972	38.9105	138.59	11.0123	0.1848	5.90	2.10	57.00	96.00	<0.1	<0.05	9.60E-7	8.85E-5	1.30E-4			484953001
U636	1.7972	37.9052	146.12	11.0123	0.1848	5.86	2.10	59.00	91.00	<0.1	<0.05	9.36E-7	8.93E-5	1.20E-4			484953001
U637	1.7972	36.8543	153.10	11.0123	0.1848	5.88	2.60	60.00	85.00	<0.1	<0.05	1.13E-6	8.85E-5	1.10E-4			484953001
U638	1.7972	36.3237	160.05	11.0123	0.1848	5.84	2.60	54.00	75.00	<0.1	<0.05	1.11E-6	7.83E-5	9.51E-5			484953001
U639	1.7972	37.1412	166.09	11.0123	0.1848	5.82	2.60	55.00	65.00	<0.1	<0.05	1.14E-6	8.16E-5	8.42E-5			484953001
U640	1.7972	50.9447	181.22	11.0123	0.1848	5.89	3.40	32.00	38.00	<0.1	<0.05	2.04E-6	6.51E-5	6.76E-5			484953001
U641	1.7972	43.2480	188.06	11.0122	0.1848	5.92	1.90	28.00	49.00	<0.1	<0.05	9.66E-7	4.83E-5	7.40E-5			484953001
U642	1.7972	47.3748	195.08	11.0122	0.1848	5.90	1.50	16.00	44.00	0.10	<0.05	8.35E-7	3.03E-5	7.27E-5	6.92E-8		484953001
U643	1.7972	50.9038	202.13	11.0122	0.1848	5.91	1.50	13.00	32.00	0.10	<0.05	8.98E-7	2.64E-5	5.68E-5	7.44E-8		484953001
U644	1.7972	39.3592	209.12	11.0122	0.1848	5.79	4.50	38.50	38.00		0.130	2.08E-6	8.05E-5	5.22E-5	0.00E+0	1.60E-7	484953001
U645	1.7972	104.1460	215.05	11.0122	0.1848	5.86	1.59	2.46	49.00		0.060	1.95E-6	1.02E-5	1.78E-4	0.00E+0	1.96E-7	484953001
U646	1.7972	73.0853	217.07	11.0122	0.1848	5.89	1.89	8.65	19.00		0.050	1.62E-6	2.52E-5	4.85E-5	0.00E+0	1.15E-7	484953001
U647	1.7972	56.9481	223.05	11.0122	0.1848	5.89	1.50	9.50	15.00		0.020	1.00E-6	2.16E-5	2.98E-5	0.00E+0	3.57E-8	484953001
U648	1.7972	49.2329	229.59	11.0122	0.1848	5.91	1.89	8.65		<0.1	0.020	1.09E-6	1.70E-5	0.00E+0		3.09E-8	484953001
U649	1.7972	50.3306	237.08	11.0122	0.1848	5.88	1.90	7.90			0.020	1.12E-6	1.59E-5	0.00E+0	0.00E+0	3.15E-8	484953001
U650	1.7972	55.5739	250.60	11.0122	0.1848	5.90	1.90	5.30			0.020	1.24E-6	1.18E-5	0.00E+0	0.00E+0	3.48E-8	484953001
U651	1.7972	52.9238	257.61	11.0122	0.1848	5.94	2.07	4.27			<0.05	1.29E-6	9.02E-6	0.00E+0			484953001
U652	1.7972	50.5321	264.61	11.0122	0.1848	5.94	1.96	4.19			<0.05	1.16E-6	8.45E-6	0.00E+0			484953001
U653	1.7972	58.5138	271.57	11.0122	0.1848	5.96	1.64	3.31			<0.05	1.13E-6	7.73E-6	0.00E+0			484953001
U654	1.7972	54.2554	280.06	11.0122	0.1848	5.98	1.82	3.32			<0.05	1.16E-6	7.19E-6	0.00E+0			484953001
U655	1.7972	52.7383	285.09	11.0122	0.1848	5.91	1.76	2.99	5.00	<0.1	<0.05	1.09E-6	8.30E-6	9.20E-6			484953001
U656	1.7972	56.1815	293.07	11.0122													

U659	1.7972	46.6001	313.09	11.0122	0.1848	5.99	1.53	2.64	13.00	<0.1	<0.05	8.38E-7	4.91E-6	2.11E-5		484953001	
U660	1.7972	53.9153	328.42	11.0122	0.1848	6.00	1.17	2.12	21.00	<0.1	<0.05	7.42E-7	4.56E-6	3.95E-5		484953001	
U661	1.7972	50.0339	334.28	11.0122	0.1848	6.00	1.05	1.83	20.00	<0.1	<0.05	6.18E-7	3.66E-6	3.49E-5		484953001	
U662	1.7972	45.1168	348.42	11.0122	0.1848	5.91	1.51	2.32	10.00	0.18	0.041	8.01E-7	4.18E-6	1.57E-5	1.19E-7	5.80E-8	484953001
U663	1.7972	77.9535	355.40	11.0122	0.1848	5.99	0.93	1.60	26.00	0.16	0.035	8.52E-7	4.98E-6	7.07E-5	1.82E-7	8.55E-8	484953001
U664	1.7972	56.0555	362.40	11.0122	0.1848	5.90	1.15	1.78	15.00	0.15	0.034	7.58E-7	3.98E-6	2.93E-5	1.23E-7	5.97E-8	484953001
U665	1.7972	37.5537	371.38	11.0122	0.1848	5.84	1.53	2.21	26.00	0.18	0.033	6.75E-7	3.31E-6	3.41E-5	9.88E-8	3.88E-8	484953001
U666	1.7972	73.2279	377.89	11.0122	0.1848	5.97	1.13	2.07	12.00	0.07	0.033	9.73E-7	6.05E-6	3.07E-5	7.49E-8	7.57E-8	484953001
U667	1.7972	55.3389	384.91	11.0122	0.1848	6.35	0.98	1.57	9.00	0.06	0.036	6.38E-7	3.47E-6	1.74E-5	4.85E-8	6.24E-8	484953001
U668	1.7972	44.0315	392.88	11.0122	0.1848	6.05	0.70	0.23		0.07	0.114	3.61E-7	4.08E-7	4.31E-8	1.57E-7	484953001	
U669	1.7972	45.9625	404.86	11.0122	0.1848	6.03										484953001	
U670	1.7972	45.5361	418.86	11.0122	0.1848	6.03	0.55	0.39		0.03	0.066	2.94E-7	7.02E-7		1.73E-8	9.42E-8	484953001
U671	1.7972	41.9589	432.92	11.0122	0.1848	5.97										484953001	
U672	1.7972	37.3551	447.90	11.0122	0.1848	6.02	0.97300	1.05		0.03	0.053	4.27E-7	1.57E-6		1.80E-8	6.20E-8	484953001
U673	1.7972	39.8969	460.94	11.0122	0.1848	5.99										484953001	
U674	1.7972	39.5246	474.91	11.0122	0.1848	6.06	0.87	0.83		0.04	0.038	4.05E-7	1.30E-6		2.08E-8	4.71E-8	484953001
U675	1.7972	34.1918	490.84	11.0122	0.1848	5.97						0.00E+0	0.00E+0				484953001
U676	1.7972	32.7833	498.89	11.0122	0.1848	6.00	0.95	0.82		0.07	0.025	3.68E-7	1.08E-6		3.31E-8	2.57E-8	484953001
U677	1.7972	30.8323	510.91	11.0122	0.1848	5.96						0.00E+0	0.00E+0				484953001
U678	1.7972	30.4434	516.89	11.0122	0.1848	5.95	0.96	1.00		<0.021	0.008	3.44E-7	1.22E-6			7.63E-9	484953001
U679	1.7972	31.1790	524.89	11.0122	0.1848	5.96						0.00E+0	0.00E+0				484953001
U680	1.7972	29.9710	544.98	11.0122	0.1848	5.95	1.06	0.97		0.02	<0.003	3.73E-7	1.16E-6		8.32E-9		484953001
U681	1.7972	30.2846	566.89	11.0122	0.1848	5.97	1.08	1.00		<0.018	<0.003	3.84E-7	1.21E-6				484953001
U682	1.7972	29.8734	588.88	11.0122	0.1848	5.94	1.08	0.99		0.04	<0.003	3.79E-7	1.18E-6		1.57E-8		484953001
U683	1.7972	32.2262	615.90	11.0122	0.1848	5.93	1.01	0.89		<0.021	<0.003	3.83E-7	1.15E-6				484953001
U684	1.7972	31.1223	637.91	11.0122	0.1848	6.00	1.00	0.85		0.02	<0.003	3.66E-7	1.06E-6		7.28E-9		484953001
U685	1.7972	33.2232	670.84	11.0122	0.1848	5.93	1.07	0.86		<0.021	<0.003	4.18E-7	1.14E-6				484953001
U686	1.7972	42.7294	692.92	11.0122	0.1848	5.94	2.55	1.72		0.22	0.036	1.28E-6	2.93E-6		1.37E-7	4.82E-8	484953001
U687	1.7972	44.6730	728.88	11.0122	0.1848	5.98	0.63	0.53		0.03	<0.003	3.31E-7	9.45E-7		2.02E-8		484953001
U688	1.7972	46.0952	769.77	11.0122	0.1848	5.86	0.66	0.60		0.07	<0.003	3.58E-7	1.10E-6		4.38E-8		484953001
U689	1.7972	50.2475	803.92	11.0122	0.1848	5.96	0.27	0.21		<0.024	<0.003	1.59E-7	4.21E-7				484953001
U690	1.7972	51.5173	827.93	11.0122	0.1848	6.05	0.60	0.46		0.04	0.015	3.66E-7	9.36E-7		2.63E-8	2.42E-8	484953001
U691	1.7972	50.5307	846.89	11.0122	0.1848	6.02	0.24	0.16		<0.015	0.016	1.40E-7	3.15E-7			2.53E-8	484953001
U692	1.7972	46.1601	887.76	11.0122	0.1848	6.04	0.36	0.28		<0.015	0.012	1.96E-7	5.07E-7			1.74E-8	484953001
U693	1.7972	42.6300	908.91	11.0122	0.1848	5.97	0.26	0.23		<0.015	0.011	1.31E-7	3.83E-7			1.47E-8	484953001
U694	1.7972	43.4776	944.87	11.0122	0.1848	6.11	0.23	0.12		<0.015	0.008	1.16E-7	2.03E-7			1.09E-8	484953001
U695	1.7972	44.3484	971.90	11.0122	0.1848	5.99	0.20	0.15		0.05	0.01	1.04E-7	2.87E-7		3.50E-8	1.39E-8	484953001
U696	1.7972	44.4032	1009.86	11.0122	0.1848	6.01	0.17	0.14		0.04	0.01	8.87E-8	2.39E-7		2.60E-8	1.39E-8	484953001
U697	1.7972	45.7604	1036.82	11.0122	0.1848	6.10	0.08	0.08		0.03	0.01	4.30E-8	1.48E-7		2.21E-8	1.43E-8	484953001
U698	1.7972	42.9641	1062.87	11.0122	0.1848	6.21	0.07	0.07		0.03	0.01	3.54E-8	1.12E-7		2.07E-8	1.35E-8	484953001
U699	1.7972	44.5016	1128.43	11.0122	0.1848	6.21	0.11	0.09		0.04	0.01	5.75E-8	1.67E-7		2.34E-8	1.39E-8	484953001
U700	1.7972	44.8508	1176.79	11.0122	0.1848	6.00	0.32	0.39		0.04	0.01	1.69E-7	6.93E-7		2.49E-8	1.41E-8	484953001
U701	1.7972	42.7977	1219.83	11.0122	0.1848	6.02	0.90	0.49		0.04	0.01	4.53E-7	8.32E-7		2.56E-8	1.34E-8	484953001
average	1.7972					5.94											
% loss		0.0055															

25 C data	Mass Ceramics	Flow Rate	Run time	Diameter	Surf. Area	pH	U	Ce	Ca	Ti	Hf	NR-U	NR-Ce	NR-Ca	NR-Ti	NR-Hf	#Particles
		(g)	(mL/day)	(days)	(microns)	(sq. m)	ppb	ppb	ppb	ppb	ppb	g/m^2/day	g/m^2/day	g/m^2/day	g/m^2/day	g/m^2/day	
U801	1.8497	18.5166	0.52	11.0124	0.1901	8.30	2.00	<1				4.11E-7					499091729
U802	1.8497	19.7552	2.13	11.0124	0.1901	7.78	1.00	<1				2.19E-7					499091729
U803	1.8497	19.6623	5.42	11.0124	0.1901	7.70	2.00	<1				4.38E-7					499091729
U804	1.8497	19.7667	7.47	11.0124	0.1901	7.81	2.00	<1				4.39E-7					499091729
U805	1.8497	20.0322	9.13	11.0124	0.1901	7.80	2.00	<1				4.45E-7					499091729
U806	1.8497	20.0884	12.39	11.0124	0.1901	7.76	2.00	<1				4.48E-7					499091729
U807	1.8497	20.5858	14.38	11.0124	0.1901	7.78	2.43	0.01	25.00	0.06	<0.01	5.55E-7	7.76E-9	1.70E-5	1.70E-8		499091729
U808	1.8497	20.6463	16.15	11.0124	0.1901	7.71	2.70	0.01	35.00	0.10	<0.01	6.19E-7	7.78E-9	2.38E-5	2.85E-8		499091729
U809	1.8497	21.0136	19.07	11.0124	0.1901	7.81	2.70	0.01	68.00	0.10	<0.01	6.30E-7	7.92E-9	4.71E-5	2.90E-8		499091729
U810	1.8497	21.2164	21.07	11.0124	0.1901	7.81	3.52	0.01		0.08	<0.01	8.29E-7	8.00E-9		2.34E-8		499091729
U811	1.8497	21.3963	23.08	11.0124	0.1901	7.90	4.31	0.01		0.10	<0.01	1.02E-6	8.06E-9		2.95E-8		499091729
U812	1.8497	21.5493	26.07	11.0124	0.1901	7.88	3.31	0.01	6.00	0.10	<0.01	7.92E-7	8.12E-9	4.28E-6	2.97E-8		499091729
U813	1.8497	21.8252	29.08	11.0124	0.1901	7.71	3.62	0.01	67.00	0.30	<0.01	8.77E-7	8.23E-9	4.82E-5	9.03E-8		499091729
U814	1.8497	22.0713	33.10	11.0124	0.1901	7.78	4.08	0.01	7.00	0.01	<0.01	9.99E-7	8.32E-9	5.09E-6	3.04E-9		499091729
U815	1.8497	22.3517	36.06	11.0124	0.1901	7.86	4.04	0.01	60.00	0.09	<0.01	1.00E-6	8.43E-9	4.42E-5	2.78E-8		499091729
U816	1.8497	22.5963	40.07	11.0124	0.1901	7.76	4.49	0.01	n.d.	0.00	<0.01	1.13E-6	8.52E-9		0.00E+0		499091729
U817	1.8497	22.8433	43.09	11.0124	0.1901	7.69	4.85	0.01	6.00	0.12	<0.01	1.23E-6	8.61E-9	4.52E-6	3.78E-8		499091729
U818	1.8497	23.9610	51.11	11.0124	0.1901	7.64	5.72	0.01	n.d.	0.10	<0.01	1.52E-6	9.03E-9		3.31E-8		499091729
U819	1.8497	33.6336	62.09	11.0124	0.1901	7.68	5.89	0.01	4.00	0.15	0.010	2.20E-6	1.27E-8	4.43E-6	6.96E-8	9.95E-9	499091729
U820	1.8497	35.2974	69.09	11.0124	0.1901	7.62	6.66	0.01		0.11	<0.01	2.61E-6	1.33E-8	0.00E+0	5.38E-8		499091729
U821	1.8497	35.7094	72.04	11.0124	0.1901	7.76	2.52	0.00	n.d.	0.14	<0.01	9.99E-7	0.00E+0		6.90E-8		499091729
U822	1.8497	36.6394	75.59	11.0124	0.1901	7.79	2.58	0.01	n.d.	0.04	<0.01	1.05E-6	1.38E-8		2.02E-8		499091729
U823	1.8497	36.9093	79.08	11.0124	0.1901	7.70	3.33	0.00	n.d.	0.06	<0.01	1.36E-6	0.00E+0		3.06E-8		499091729
U824	1.8497	36.7144	83.08	11.0124	0.1901	7.60	4.21	<0.01	n.d.	0.08	<0.01	1.72E-6			4.05E-8		499091729
U825	1.8497	37.5492	86.07	11.0124	0.1901	7.66	4.46	0.01	n.d.	0.10	<0.01	1.85E-6	1.42E-8		5.18E-8		499091729
U826	1.8497	37.7530	90.10	11.0124	0.1901	7.59	4.72	<0.01	n.d.	0.05	<0.01	1.98E-6			2.60E-8		499091729
U827	1.8497	38.1751	97.58	11.0124	0.1901	7.61	4.95	0.04	n.d.	0.10	<0.01	2.10E-6	5.76E-8		5.27E-8		499091729
U828	1.8497	35.4941	100.10	11.0124	0.1901	7.53	5.11	<0.01	n.d.	0.17	<0.01	2.01E-6			8.32E-8		499091729
U829	1.8497	30.2841	104.54	11.0124	0.1901	7.49	4.93	<0.01	5.00	0.13	<0.01	1.66E-6		4.99E-6	5.43E-8		499091729
U830	1.8497	31.1236	107.12	11.0124	0.1901	7.49	4.79	<0.01	31.00	0.06	<0.01	1.65E-6		3.18E-5	2.58E-8		499091729
U831	1.8497	17.1260	111.50	11.0124	0.1901	7.62	4.93	<0.01	n.d.	0.08	<0.01	9.37E-7			1.89E-8		499091729
U832	1.8497	14.6864	117.78	11.0124	0.1901	7.50	4.97	0.01	n.d.	0.21	<0.01	8.10E-7	5.54E-9		4.26E-8		499091729
U833	1.8497	13.9454	125.74	11.0124	0.1901	7.71	4.83	0.01	n.d.	0.07	<0.01	7.47E-7	5.26E-9		1.35E-8		499091729
U834	1.8497	41.8079	134.56	11.0124	0.1901	7.82	2.17	<0.01	23.00	0.00	<0.01	1.00E-6		3.15E-5	0.00E+0		499091729
U835	1.8497	41.5482	138.59	11.0124	0.1901	7.70	2.70	<0.01	10.00	0.03	<0.01	1.24E-6		1.37E-5	1.72E-8		499091729
U836	1.8497	41.0686	146.12	11.0124	0.1901	7.67	3.32	<0.01	6.60	0.03	<0.01	1.51E-6		8.93E-6	1.70E-8		499091729
U837	1.8497	41.5176	153.10	11.0124	0.1901	7.55	3.38	<0.01	4.10	0.07	<0.01	1.56E-6		5.61E-6	4.01E-8		499091729
U838	1.8497	42.2007	160.05	11.0124	0.1901	7.55	3.39	<0.01	8.10	0.05	0.010	1.59E-6		1.13E-5	2.91E-8	1.25E-8	499091729
U839	1.8497	42.5795	166.09	11.0124	0.1901	7.49	3.20	0.03	5.00	0.04	<0.01	1.51E-6	4.81E-8	7.01E-6	2.35E-8		499091729
U840	1.8497	53.4814	181.22	11.0124	0.1901	7.56	2.21	<0.01	7.40	0.05	0.010	1.31E-6		1.30E-5	3.69E-8	1.58E-8	499091729
U841	1.8497	55.0101	188.06	11.0124	0.1901	7.79	1.63	<0.01	5.10	0.08	0.020	9.95E-7		9.24E-6	6.07E-8	3.26E-8	499091729
U842	1.8497	57.1844	195.08	11.0124	0.1901	7.70	1.84	<0.01	n.d.	0.03	0.020	1.17E-6			2.37E-8	3.38E-8	499091729
U843	1.8497	63.3272	202.13	11.0124	0.1901	7.66	2.23	<0.01	n.d.	0.03	0.030	1.57E-6			2.62E-8	5.62E-8	499091729
U844	1.8497	22.8589	209.12	11.0124	0.1901	7.70	1.40	0.12	5.00		0.050	3.55E-7	1.03E-7	3.77E-6		3.38E-8	499091729
U845	1.8497	61.2446	215.05	11.0124	0.1901	7.98	1.10	0.01	1.00	<0.1	0.060	7.48E-7	1.39E-6	2.02E-6	1.09E-7		499091729
U846	1.8497	81.0634	217.07	11.0124	0.1901	8.04	0.40	0.01	6.00		0.060	3.80E-7	3.06E-6	1.60E-5	1.44E-7		499091729
U847	1.8497	79.9876	223.05	11.0124	0.1901	7.96	0.90	0.05	2.00		0.020	7.99E-7	1.51E-7	5.27E-6	4.73E-8		499091729
U848	1.8497	79.1448	229.59	11.0124	0.1901	7.80	1.21	0.01	n.d.<1	<0.1	0.020	1.06E-6	2.98E-6		4.68E-8		499091729
U849	1.8497	81.5165	237.08	11.0124	0.1901	7.70	1.80	0.07			0.020	1.63E-6	2.15E-7		4.82E-8		499091729
U850	1.8497	78.7897	250.60	11.0124	0.1901	7.72	1.20	0.04			0.010	1.05E-6	1.19E-7		2.33E-8		499091729
U851	1.8497	77.7925	257.61	11.0124	0.1901	7.86	0.64				<0.05	5.53E-7				499091729	
U852	1.8497	76.7422	264.61	11.0124	0.1901	7.82	0.98				<0.05	8.35E-7				499091729	
U853	1.8497	78.2882	271.57	11.0124	0.1901	7.85	0.74				<0.05	6.43E-7				499091729	
U854	1.8497	77.8638	280.06	11.0124	0.1901	7.79	1.08				<0.05	9.33E-7				499091729	
U855	1.8497	78.5962	285.09	11.0124	0.1901	7.72	1.14	<0.005	14.00	<0.10	<0.05	9.96E-7		3.83E-5			499091729
U856	1.8497	78.9867	293.07	11.0124	0.1901	7.79	0.94	<0.005	14.00	<0.10	<0.05	8.24E-7		3.64E-5			499091729
U857	1.8497	78.5793	300.11	11.0124	0.1901	7.76	1.04	<0.005	20.00	<0.10	<0.05	9.07E-7		5.18E-5			499091729
U858	1.8497	79.1059	306.08	11.0124	0.1901	7.69	1.12	<0.005	30.00	<0.10	<0.05	9.83E-7		7.82E-5			499091729

U859	1.8497	77.9969	313.09	11.0124	0.1901	7.86	0.01	<0.005	13.00	<0.10	<0.05	8.66E-9	3.34E-5		499091729			
U860	1.8497	78.4235	328.49	11.0124	0.1901	7.80	0.79	<0.005	15.00	<0.10	<0.05	6.88E-7	3.88E-5		499091729			
U861	1.8497	78.2302	334.28	11.0124	0.1901	7.76	0.88	<0.005	26.00	<0.10	<0.05	7.64E-7	6.70E-5		499091729			
U862	1.8497	79.5794	348.42	11.0124	0.1901	7.65	1.02	0.14	26.00	0.02	0.032	9.01E-7	4.20E-7	6.82E-5	1.65E-8	7.53E-8	499091729	
U863	1.8497	78.9312	355.40	11.0124	0.1901	7.97	1.27	0.14	12.00	0.04	0.031	1.11E-6	4.17E-7	3.12E-5	4.03E-8	7.24E-8	499091729	
U864	1.8497	77.4842	362.40	11.0124	0.1901	7.83	0.53	0.14	22.00	0.04	0.030	4.56E-7	4.09E-7	5.62E-5	4.17E-8	6.88E-8	499091729	
U865	1.8497	77.7312	371.38	11.0124	0.1901	7.75	0.78	0.14	26.00	0.03	0.029	6.73E-7	4.10E-7	6.66E-5	2.79E-8	6.67E-8	499091729	
U866	1.8497	77.9674	377.89	11.0124	0.1901	7.72	0.87	0.14	12.00	0.04	0.032	7.53E-7	4.11E-7	3.08E-5	3.98E-8	7.38E-8	499091729	
U867	1.8497	78.6305	384.91	11.0124	0.1901	8.12	0.66	0.14	19.00	0.04	0.032	5.76E-7	4.15E-7	4.92E-5	4.23E-8	7.44E-8	499091729	
U868	1.8497	72.8737	392.88	11.0124	0.1901	7.01	0.54	0.03		0.02	0.015	4.37E-7	6.87E-8		1.71E-8	3.23E-8	499091729	
U869	1.8497	52.9202	404.86	11.0124	0.1901	6.97											499091729	
U870	1.8497	51.0646	418.86	11.0124	0.1901	7.20	1.28	0.01		0.04	0.010	7.26E-7	1.92E-8		2.96E-8	1.51E-8	499091729	
U871	1.8497	48.7840	432.92	11.0124	0.1901	7.17											499091729	
U872	1.8497	47.3644	447.90	11.0124	0.1901	7.63	1.17	0.01		0.04	0.008	8.13E-7	2.14E-8		2.61E-8	1.12E-8	499091729	
U873	1.8497	48.4252	460.94	11.0124	0.1901	7.52											499091729	
U874	1.8497	47.9447	474.91	11.0124	0.1901	7.60	0.39	0.01		0.20	0.005	2.08E-7	2.35E-8		1.33E-7	7.09E-9	499091729	
U875	1.8497	46.3430	490.84	11.0124	0.1901	7.58											499091729	
U876	1.8497	46.1817	498.89	11.0124	0.1901	7.76	0.48	0.01		0.02	0.004	2.44E-7	2.09E-8		1.21E-8	5.47E-9	499091729	
U877	1.8497	45.5732	510.91	11.0124	0.1901	7.51											499091729	
U878	1.8497	44.9350	516.89	11.0124	0.1901	7.49	0.72	<0.01		0.14	<0.004	3.59E-7			8.37E-8		499091729	
U879	1.8497	45.4044	524.89	11.0124	0.1901	7.45											499091729	
U880	1.8497	43.5988	544.98	11.0124	0.1901	7.56	0.64	0.02		<0.033	<0.004	3.10E-7	2.47E-8				499091729	
U881	1.8497	41.5602	566.89	11.0124	0.1901	7.55	0.72	0.02		<0.024	<0.004	3.32E-7	2.82E-8				499091729	
U882	1.8497	41.7459	588.88	11.0124	0.1901	7.65	0.34	<0.01		<0.021	<0.004	1.58E-7					499091729	
U883	1.8497	40.8741	615.90	11.0123	0.1901	7.55	0.60	<0.01		<0.021	<0.004	2.72E-7					499091729	
U884	1.8497	39.4358	637.91	11.0123	0.1901	7.38	0.67	<0.01		0.09	<0.004	2.93E-7			5.11E-8		499091729	
U885	1.8497	38.6075	670.84	11.0123	0.1901	7.76	0.36	0.01		0.03	<0.004	1.54E-7	1.60E-8		1.44E-8		499091729	
U886	1.8497	38.5588	692.92	11.0123	0.1901	7.58	0.68	<0.01		0.03	<0.004	2.91E-7			1.54E-8		499091729	
U887	1.8497	43.4730	728.88	11.0123	0.1901	7.57	0.77	<0.01		0.04	<0.004	3.71E-7			2.22E-8		499091729	
U888	1.8497	44.8009	769.77	11.0123	0.1901	7.55	0.66	0.01		0.05	<0.004	3.28E-7	2.36E-8		3.34E-8		499091729	
U889	1.8497	46.6176	803.92	11.0123	0.1901	7.58	0.47	<0.01		0.02	<0.004	2.43E-7			1.48E-8		499091729	
U890	1.8497	44.6034	827.93	11.0123	0.1901	7.64	0.52	0.02		0.03	0.004	2.59E-7	2.86E-8		1.91E-8	5.28E-9	499091729	
U891	1.8497	42.9883	846.89	11.0123	0.1901	7.47	0.38	0.01		0.04	0.002	1.82E-7	2.27E-8		2.31E-8	2.54E-9	499091729	
U892	1.8497	41.1643	887.76	11.0123	0.1901	7.50	0.41	0.02		<0.01	0.002	1.85E-7	2.33E-8		2.44E-9		499091729	
U893	1.8497	38.9363	908.91	11.0123	0.1901	7.41	0.43	0.02		0.02	0.002	1.85E-7	3.08E-8		1.18E-8	2.30E-9	499091729	
U894	1.8497	36.6041	944.87	11.0123	0.1901	7.69	0.58	0.07		<0.01	0.003	2.37E-7	9.93E-8			2.82E-9		499091729
U895	1.8497	36.7827	971.90	11.0123	0.1901	7.94	0.26	0.02		0.04	0.010	1.06E-7	2.91E-8		1.93E-8	1.09E-8	499091729	
U896	1.8497	37.7541	1009.86	11.0123	0.1901	7.93	0.40	0.02		0.03	0.010	1.68E-7	2.28E-8		1.72E-8	1.12E-8	499091729	
U897	1.8497	37.8787	1036.82	11.0123	0.1901	7.73	0.51	0.02		0.03	0.010	2.14E-7	2.28E-8		1.57E-8	1.12E-8	499091729	
U898	1.8497	35.9055	1062.87	11.0123	0.1901	7.81	0.19	0.01		0.03	0.010	7.57E-8	1.89E-8		1.63E-8	1.06E-8	499091729	
U899	1.8497	36.7130	1128.43	11.0123	0.1901	7.81	0.40	0.03		0.04	0.010	1.63E-7	3.60E-8		2.08E-8	1.09E-8	499091729	
U900	1.8497	39.0012	1178.79	11.0123	0.1901	7.62	0.05	0.01		0.03	0.010	2.16E-8	1.47E-8		1.72E-8	1.15E-8	499091729	
U8101	1.8497	33.8705	1219.83	11.0123	0.1901	7.51	0.30	0.04		0.05	0.120	1.13E-7	4.98E-8		2.43E-8	1.20E-7	499091729	
average	1.8497					7.67												
% loss		0.0017																

Pu Dissolution Project (U-Ce-Ca-Ti-Hf samples)

Experiments Terminated on : 2/3/1998 5:00:00 PM

Experiments Started on : 11/9/2000 1:56:00 PM

pH 9.10 ceramic sample ID: P133

Sample: U-Ce-Ti-Ca Ceramic

Starting SA= 0.1028 m^2/g

ceramic density 5.19 g/cm^3

33.148

5.190E-12 g/μ^3

Element WtFrac Element

U 0.2562

Ce 0.0754

Ca 0.0863

Ti 0.2061

Hf 0.0961

Surface Area Calculation	
assume spherical particles	
diameter(microns) =	11.245811
num.particles/g =	258739094

Formulae for cell entries

Nr_Rate= Concentration(ppb) * 0.000001 * FlowRate(mL/day) *

0.001 / SampleMass(g) / SurfaceArea(m^2/g) * Wt_Fraction

SampleMass= Init. wt. - (day elapsed * FlowRate (mL/day) *

((ppbU * Wt_Fraction)+(ppbCe* Ce_Wt_Fraction)+...+)*0.000001

Diameter= 2* (SampleMass(i)^0.75/n/Density(g/cm.mic.)^#Particles)^{1/3}

Note that Initial Diameter is assumed to be the same for all runs.

Surface Area (m^2/g) = # Particles*4*π*((Diameter(m)/2)^2)*10^2

Particles= Sample Mass (g) * # Particles/gram

Particles/gram = Surface Area (m^2/g) / 4*π*(Initial Diameter(m)/2)^2)**

**Value of # Particles/g is kept constant through out a run.

Initial Diameter (um): 2*3/SurfaceArea((10^4 um)^2/g/Density(g/(10^4 um))^3)

0.005 m NaHCO3 + 0.00025 m HCl

25 C data	Mass Ceramics	Flow Rate	Run time	Diameter	Surf. Area	pH	U	Ce	Ca	Ti	Hf	NR-U	NR-Ce	NR-Ca	NR-Ti	NR-Hf	#Particles
PH 9	(g)	(mL/day)	(days)	(microns)	(sq. m)	pH	U	Ce	Ca	Ti	Hf	NR-U	NR-Ce	NR-Ca	NR-Ti	NR-Hf	278610256
start	1.07680	32.8872	0.34	11.246	0.11069	8.71	ppb	ppb	ppb	ppb	n.d.<1	9.12E-4	1.10E-6	4.19E-3	8.03E-7	278610256	
U9.01	1.07680	43.4237	0.86	11.246	0.11069	8.62	847.000	0.30	1312.00	0.600	n.d.<1	2.76E-4	1.06E-6	2.20E-3	1.41E-6	278610256	
U9.02	1.07679	43.9004	1.85	11.246	0.11069	8.61	194.000	0.22	520.00	0.800	n.d.<1	1.22E-4	1.42E-6	5.72E-4	278610256		
U9.03	1.07679	45.2854	5.86	11.246	0.11069	8.68	28.000	0.32	269.00	0.200	n.d.<1	4.15E-5	1.81E-6	1.18E-3	3.69E-7	278610256	
U9.04	1.07679	45.4192	7.83	11.246	0.11069	8.63	20.000	0.47	35.00	0.600	n.d.<1	3.01E-5	2.40E-6	1.58E-4	1.12E-6	278610256	
U9.05	1.07678	46.3438	9.83	11.246	0.11069	8.75	16.000	0.46	199.00	1.100	n.d.<1	2.43E-5	2.37E-6	8.97E-4	2.08E-6	278610256	
U9.06	1.07678	49.9585	13.83	11.246	0.11069	8.75	11.000	0.47	247.00	0.500	n.d.<1	1.80E-5	2.81E-6	1.20E-3	1.02E-6	278610256	
U9.07	1.07678	51.4596	15.86	11.246	0.11069	8.80	9.400	0.29	5.00	2.700	0.09	1.58E-5	1.66E-6	2.50E-5	5.66E-6	4.04E-7	278610256
U9.08	1.07678	51.5074	20.21	11.246	0.11069	8.80	7.130	0.15		0.370	0.07	1.19E-5	8.69E-7	7.69E-7	3.12E-7	278610256	
U9.09	1.07678	35.4037	23.16	11.246	0.11069	8.79	5.480	0.11		0.310	<0.05	6.33E-6	4.17E-7	4.47E-7	278610256		
U9.10	1.07678	18.7116	27.19	11.246	0.11069	8.76	4.700	0.16			0.07	2.88E-6	3.33E-7		1.14E-7	278610256	
U9.11	1.07678	43.3249	30.17	11.246	0.11069	8.80	4.700	0.15			0.09	6.67E-6	7.23E-7		3.40E-7	278610256	
U9.12	1.07678	47.5223	41.22	11.246	0.11069	8.81	4.400	0.13			0.08	6.85E-6	6.87E-7		3.32E-7	278610256	
U9.13	1.07678	48.8769	44.18	11.246	0.11069	8.77	4.070	0.085			0.08	6.51E-6	4.62E-7		3.41E-7	278610256	
U9.14	1.07678	78.8535	48.36	11.246	0.11069	8.78	2.590	0.059			0.12	6.89E-6	5.17E-7		8.20E-7	278610256	
U9.15	1.07678	46.7605	51.40	11.246	0.11069	8.59	3.870	0.063			0.07	5.93E-6	3.28E-7		2.86E-7	278610256	
U9.16	1.07678	45.2352	55.43	11.246	0.11069	8.82	3.730	0.054			0.07	5.53E-6	2.72E-7		2.76E-7	278610256	
U9.17	1.07678	44.7540	62.44	11.246	0.11069	8.75	3.670	0.047			<0.05	5.38E-6	2.34E-7		278610256		
U9.18	1.07678	44.2706	71.14	11.246	0.11068	8.71	2.710	0.034			0.05	3.93E-6	1.87E-7		1.93E-7	278610256	
U9.19	1.07678	44.2290	75.84	11.246	0.11069	8.81	2.850	0.021	n.d.<1	<0.10	<0.05	3.84E-6	1.03E-7		278610256		
U9.21	1.07678	43.6529	83.32	11.246	0.11059	8.81	2.160	0.013	11.00	<0.10	<0.05	3.09E-6	6.31E-8	4.67E-5	278610256		
U9.22	1.07678	77.0294	90.85	11.246	0.11069	8.77	1.550	<0.005	13	<0.10	<0.05	3.91E-6		9.74E-5	278610256		
U9.23	1.07677	73.5263	96.84	11.246	0.11069	8.78	1.440	<0.005	n.d.<1	<0.10	<0.05	3.47E-6			278610256		
U9.24	1.07677	69.9422	103.84	11.246	0.11069	8.78	1.300	0.005	n.d.<1	<0.10	<0.05	2.98E-6	3.89E-8		278610256		
U9.25	1.07677	65.4935	119.24	11.246	0.11069	8.75	1.420	0.007	16	<0.10	<0.05	3.05E-6	5.10E-8	1.02E-4	278610256		
U9.26	1.07677	61.0552	125.04	11.246	0.11069	8.82	1.150	<0.005	n.d.<1	<0.10	<0.05	2.30E-6			278610256		
U9.27	1.07677	54.6769	139.16	11.246	0.11069	8.79	1.260	0.01	n.d.<1	0.060	0.012	2.26E-6	6.08E-8		5.73E-8	278610256	
U9.28	1.07677	50.2255	146.16	11.246	0.11069	8.81	1.260	0.01	n.d.<1	0.050	0.011	2.07E-6	5.59E-8		4.82E-8	278610256	
U9.29	1.07677	78.5217	153.15	11.246	0.11069	8.75	2.480	0.72	3	1.310	0.036	6.38E-6	6.29E-6	2.29E-5	4.19E-6	2.47E-7	278610256
U9.30	1.07677	82.7175	162.13	11.246	0.11069	8.75	0.870	0.02	n.d.<1	0.060	0.007	2.36E-6	1.84E-7		2.02E-7	5.08E-8	278610256
U9.31	1.07677	81.6613	168.84	11.246	0.11069	8.78	0.850	0.02	4	0.060	0.063	2.27E-6	1.82E-7	3.18E-5	1.99E-7	4.49E-7	278610256
U9.32	1.07677	79.0613	175.86	11.246	0.11069	9.21	0.810	0.02	n.d.<1	0.030	0.058	2.10E-6	1.78E-7		9.68E-8	4.00E-7	278610256
U9.33	1.07677	48.0440	183.63	11.246	0.11069	8.3										278610256	
U9.34	1.07677	49.2169	195.62	11.246	0.11069	8.1	0.551	0.012		<0.04	0.006	8.88E-7	6.57E-8		2.58E-8	278610256	
U9.35	1.07677	49.0074	209.61	11.246	0.11069	8.07										278610256	
U9.36	1.07677	48.8152	223.68	11.246	0.11069	8.77	1.209	0.012		<0.04	0.041	1.93E-6	6.52E-8		1.75E-7	278610256	
U9.37	1.07677	48.3530	238.66	11.246	0.11069	8.75										278610256	
U9.38	1.07677	48.7086	251.69	11.246	0.11069	8.87	0.742	0.024		0.146	0.02	1.18E-6	1.30E-7		2.89E-7	8.50E-8	278610256
U9.39	1.07677	47.7282	285.67	11.246	0.11069	8.86										278610256	
U9.40	1.07677	46.7850	281.59	11.246	0.11069	8.8	0.618	0.024		0.044	0.025	9.47E-7	1.25E-7		8.38E-8	1.02E-7	278610256
U9.41	1.07677	46.9811	289.64	11.246	0.11069	8.82										278610256	
U9.42	1.07677	46.1241	301.66	11.246	0.11069	8.8	0.710	0.018		0.038	0.023	1.07E-6	8.21E-8		7.13E-8	9.26E-8	278610256
U9.43	1.07677	45.4804	307.84	11.246	0.11069	8.79										278610256	

U9.44	1.07677	45.6549	315.64	11.246	0.11069	8.78	0.620	0.012	0.035	0.029	9.27E-7	6.09E-8	6.50E-8	1.16E-7	278810256
U9.45	1.07677	45.0984	335.73	11.246	0.11069	8.79	0.570	0.005	0.034	0.024	8.42E-7	2.51E-8	6.24E-8	9.45E-8	278810256
U9.46	1.07677	44.5892	357.64	11.246	0.11069	8.87	0.470	0.003	0.035	0.032	6.86E-7	1.49E-8	6.35E-8	1.25E-7	278810256
U9.47	1.07677	42.1458	379.64	11.246	0.11069	8.73	0.980	0.001	0.026	0.008	1.35E-8	4.69E-8	4.46E-8	2.94E-8	278810256
U9.48	1.07677	41.9880	406.85	11.246	0.11069	8.74	0.490	0.005	0.027	0.006	6.74E-7	2.34E-8	4.61E-8	2.20E-8	278810256
U9.49	1.07677	41.5565	428.87	11.246	0.11069	8.84	0.450	0.003	0.035	0.01	6.12E-7	1.39E-8	5.92E-8	3.63E-8	278810256
U9.50	1.07677	41.5864	461.59	11.246	0.11069	8.72	0.360	0.001	0.026	0.011	4.90E-7	4.83E-8	4.40E-8	3.99E-8	278810256
U9.51	1.07677	40.2406	483.87	11.246	0.11069	8.85	0.360	0.003	0.030	0.016	4.74E-7	1.34E-8	4.91E-8	5.62E-8	278810256
U9.52	1.07677	41.9495	519.83	11.246	0.11069	8.86	0.280	0.003	0.046	0.015	3.85E-7	1.40E-8	7.86E-8	5.49E-8	278810256
U9.53	1.07677	58.1547	560.52	11.246	0.11069	8.68	0.170	0.005	0.070	0.015	3.24E-7	3.23E-8	1.66E-7	7.62E-8	278810256
U9.54	1.07677	50.7808	594.87	11.246	0.11069	8.83	0.170	0.003	0.029	0.005	2.83E-7	1.69E-8	5.99E-8	2.22E-8	278810256
U9.55	1.07677	43.5218	618.69	11.246	0.11069	8.89	0.254	0.021	<0.04	0.034	3.62E-7	1.02E-7	1.29E-7	278810256	
U9.56	1.07677	43.5388	637.64	11.246	0.11069	8.85	0.219	0.015	0.062	0.027	3.12E-7	7.26E-8	1.10E-7	1.03E-7	278810256
U9.57	1.07677	43.1010	678.52	11.246	0.11069	8.75	0.176	0.013	<0.04	0.021	2.48E-7	6.23E-8	7.90E-8	278810256	
U9.58	1.07677	41.6159	699.68	11.246	0.11069	8.91	0.172	0.013	<0.04	0.017	2.34E-7	6.02E-8	6.18E-8	278810256	
U9.59	1.07677	41.5930	735.63	11.246	0.11069	8.92	0.176	0.015	<0.04	0.02	2.40E-7	6.94E-8	7.26E-8	278810256	
U9.60	1.07677	37.1594	782.86	11.246	0.11069	8.92	0.180	0.026	0.069	0.02	2.19E-7	1.07E-7	1.04E-7	6.49E-8	278810256
U9.61	1.07677	40.7363	800.61	11.246	0.11069	8.92	0.170	0.019	0.065	0.02	2.27E-7	8.61E-8	1.08E-7	7.11E-8	278810256
U9.62	1.07677	38.7294	827.57	11.246	0.11069	8.88	0.150	0.022	0.061	0.02	1.90E-7	9.48E-8	9.62E-8	6.76E-8	278810256
U9.63	1.07677	42.3472	853.62	11.246	0.11069	9.02	0.160	0.016	0.067	0.01	2.22E-7	7.54E-8	1.15E-7	3.70E-8	278810256
U9.64	1.07677	40.8735	919.19	11.246	0.11069	9.02	0.160	0.015	0.070	0.02	2.14E-7	6.82E-8	1.16E-7	7.14E-8	278810256
U9.65	1.07677	37.4890	967.54	11.246	0.11069	8.75	0.150	0.011	0.063	0.02	1.84E-7	4.59E-8	9.61E-8	8.55E-8	278810256
U9.66	1.07677	29.0985	1010.58	11.246	0.11069	8.70	0.180	0.023	0.063	0.01	1.52E-7	7.44E-8	7.46E-8	2.54E-8	278810256
average	1.07677														
% loss	0.0027														

0.005 m Triethylamine + 0.0043 m HCl. Starting sample #12, buffer 0.005 m boric acid + 0.00439 m NaOH has been used instead.

25 C data	Mass	Ceramics	Flow Rate	Run time	Diameter	Surf. Area	pH	U	Ce	Ca	Tl	Hf	NR-U	NR-Ce	NR-Ca	NR-Tl	NR-Hf	#Particles
PH 10	(g)	(mL/day)	(days)	(microns)	(sq. m)		ppb	ppb	ppb	ppb	ppb	ppb	g/m^2/day	g/m^2/day	g/m^2/day	g/m^2/day	g/m^2/day	
start	1.1370		0.00	11.246	0.11688	9.81	47.000	n.d.<0.1	1885	n.d.<0.2	n.d.<1	3.61E-5	4.30E-3	8.31E-4	1.13E-6	2.94186350	294186350	
U10.01	1.1370	26.1420	0.34	11.246	0.11688	9.59	6.000	n.d.<0.1	247	0.800	n.d.<1	6.80E-6	8.31E-4	1.13E-6	2.94186350	294186350	294186350	
U10.02	1.1370	38.8051	0.86	11.246	0.11688	9.75	6.000	n.d.<0.1	809	0.800	n.d.<1	1.16E-5	3.48E-3	1.44E-6	2.94186350	294186350	294186350	
U10.03	1.1370	49.3977	1.85	11.246	0.11688	9.78	8.000	n.d.<0.1	212	n.d.<0.2	n.d.<1	8.48E-6	8.89E-4	1.44E-6	2.94186350	294186350	294186350	
U10.04	1.1370	48.1117	5.86	11.246	0.11688	9.82	6.000	n.d.<0.1	60	n.d.<0.2	n.d.<1	8.41E-6	2.50E-4	1.44E-6	2.94186350	294186350	294186350	
U10.05	1.1370	47.7033	7.83	11.246	0.11688	9.80	6.000	n.d.<0.1	36	n.d.<0.2	n.d.<1	8.36E-6	1.49E-4	1.44E-6	2.94186350	294186350	294186350	
U10.06	1.1370	47.4278	9.83	11.246	0.11688	9.77	6.000	n.d.<0.1	28	n.d.<0.2	n.d.<1	8.30E-6	1.15E-4	1.44E-6	2.94186350	294186350	294186350	
U10.07	1.1370	47.1097	13.83	11.246	0.11688	9.75	6.000	n.d.<0.1	16	n.d.<0.2			6.51E-5				294186350	
U10.08	1.1370	46.6952	15.86	11.246	0.11688	9.75											294186350	
U10.09	1.1370	46.3444	20.21	11.246	0.11688	9.05	8.460	0.087	16	<0.4	0.04	1.15E-5	3.10E-7	6.47E-5		1.45E-7	294186350	
U10.10	1.1370	45.5848	23.16	11.246	0.11688	9.02	9.260	0.05	19	<0.4	0.03	1.24E-5	2.28E-7	7.57E-5		1.07E-7	294186350	
U10.11	1.1370	46.0756	27.19	11.246	0.11688	8.09	5.400	0.05			<0.02	7.31E-6	2.30E-7				294186350	
U10.12	1.1370	47.0858	30.17	11.246	0.11688	9.84	1.300	0.08			0.03	1.80E-6	3.76E-7			1.11E-7	294186350	
U10.13	1.1370	45.3612	41.22	11.246	0.11688	9.84	6.400	0.08			0.03	8.53E-6	3.62E-7			1.07E-7	294186350	
U10.14	1.1370	45.4331	44.18	11.246	0.11688	9.78	8.260	0.044			<0.05	1.10E-5	1.99E-7				294186350	
U10.15	1.1370	46.7632	48.36	11.246	0.11688	9.88	4.840	0.045			<0.05	6.85E-6	2.10E-7				294186350	
U10.16	1.1370	47.5068	51.40	11.246	0.11688	9.76	4.080	0.05			<0.05	5.69E-6	2.37E-7				294186350	
U10.17	1.1370	44.2072	55.43	11.246	0.11688	9.78	4.160	0.05			<0.05	5.40E-6	2.21E-7				294186350	
U10.18	1.1370	41.7858	62.44	11.246	0.11688	9.75	3.830	0.053			<0.05	4.46E-6	2.21E-7				294186350	
U10.19	1.1370	38.9879	71.14	11.246	0.11688	9.78	4.620	0.055			<0.05	5.29E-6	2.14E-7				294186350	
U10.20	1.1370	37.3015	75.84	11.246	0.11688	9.75	5.280	0.048	9	0.110	<0.05	5.78E-6	1.79E-7	2.93E-5	1.50E-7		294186350	
U10.21	1.1370	34.2736	83.32	11.246	0.11688	9.7	5.330	0.049	n.d.<1	<0.10	<0.05	5.37E-6	1.68E-7				294186350	
U10.22	1.1370	88.9102	90.85	11.246	0.11688	9.69	5.710	0.054	7	0.450	<0.05	1.49E-5	4.79E-7	5.43E-5	1.48E-6		294186350	
U10.23	1.1370	39.8732	96.84	11.246	0.11688	9.5	5.180	0.044	3	0.210	0.016	6.07E-6	1.75E-7	1.04E-5	3.08E-7	5.00E-8	294186350	
U10.24	1.1370	32.8453	103.84	11.246	0.11688	9.49	6.600	0.048	4	<0.10	<0.05	6.37E-6	1.57E-7	1.15E-5			294186350	
U10.25	1.1370	22.7964	119.24	11.246	0.11688	9.84	1.380	0.025	4	0.060	0.011	9.24E-7	5.69E-8	7.95E-6	4.99E-6	1.98E-8	294186350	
U10.26	1.1370	19.0236	125.04	11.246	0.11688	9.58	2.390	0.159	5	0.070	0.015	1.34E-6	3.02E-7	8.29E-6	4.86E-8	2.23E-8	294186350	
U10.27	1.1370	12.6192	139.16	11.246	0.11688	9.83	11.120	0.04	9	0.070	0.003	4.12E-6	5.04E-8	9.90E-6	3.23E-8	2.98E-9	294186350	
U10.28	1.1370	82.853	146.16	11.246	0.11688	9.84	3.930	0.12	3	0.110	0.001	8.58E-6	9.92E-7	2.17E-5	3.33E-7	6.49E-9	294186350	
U10.29	1.1370	82.0652	153.15	11.246	0.11688	9.56	3.880	0.12	26	0.110	0.002	8.87E-6	9.82E-7	1.86E-4	3.30E-7	1.29E-8	294186350	
U10.30	1.1370	81.1118	162.13	11.246	0.11688	9.56	0.240	0.07	n.d.<1	0.040	0.002	5.72E-7	5.66E-7	1.18E-7	1.27E-8		294186350	
U10.31	1.1370	79.4365	168.64	11.246	0.11688	9.97	0.880	0.06	n.d.<1	0.040	0.001	2.05E-6	4.75E-7	1.18E-7	6.22E-9		294186350	
U10.32	1.1370	78.0334	175.66	11.246	0.11688	10.35	1.010	0.09	4	0.050	0.001	2.26E-6	6.83E-7	2.65E-5	1.39E-7	5.95E-9	294186350	
U10.33	1.1370	48.022	183.63	11.246	0.11688	9.57											294186350	
U10.34	1.1335	50.627	195.62	11.234	0.11684	8.86	1.498	0.047		<0.1	<0.005	2.24E-6	2.38E-7				294186350	
U10.35	1.1335	50.7533	209.61	11.234	0.11684	8.22											294186350	
U10.36	1.1300	49.9115	223.68	11.223	0.11640	9.75	0.982	0.068		<0.1	<0.005	1.45E-6	3.41E-7				294186350	
U10.37	1.1300	49.1057	238.66	11.223	0.11640	9.53											294186350	
U10.38	1.1300	48.5389	251.69	11.223	0.11640	9.56	0.777	0.082		0.608	0.007	1.12E-6	4.01E-7		1.09E-6	2.69E-8	294186350	
U10.39	1.1300	46.992	265.87	11.223	0.11640	9.51											294186350	
U10.40	1.1300	45.4099	281.59	11.223	0.11640	9.27	3.153	0.052		0.151	<0.005	4.25E-6	2.38E-7		2.53E-7		294186350	
U10.41	1.1300	43.6323	289.64	11.223	0.11640	9.68											294186350	
U10.42	1.1300	41.2041	301.66	11.223	0.11640	9.63	0.600	0.012		0.050	0.008	7.34E-7	4.98E-8		7.60E-8	2.81E-8	294186350	
U10.43	1.1300	39.8646	307.64	11.223	0.11640	9.8											294186350	
U10.44	1.1300	39.1805	315.64	11.223	0.11640	9.84	1.210	0.021		0.040	<0.004	1.41E-6	8.29E-8		5.78E-8		294186350	
U10.45	1.1300	37.8165	335.73	11.223	0.11640	9.6	0.720	0.011		0.030	<0.004	8.04E-7	4.17E-8		4.16E-8		294186350	
U10.46	1.1300	36.3276	357.64	11.223	0.11640	9.53	1.630	0.034		0.030	<0.004	1.76E-6	1.24E-7		4.02E-8		294186350	
U10.47	1.1300	33.6386	379.64	11.223	0.11640	9.48	1.840	0.014		0.010	<0.004	1.84E-6	4.75E-8		1.24E-8		294186350	
U10.48	1.1300	31.5197	406.65	11.223	0.11640	9.74	0.420	0.023		0.010	<0.004	3.93E-7	7.31E-8		1.16E-8		294186350	
U10.49	1.1300	30.5636	428.67	11.223	0.11640	9.89	0.860	0.027		0.010	<0.004	7.80E-7	8.32E-8		1.13E-8		294186350	
U10.50	1.1300	28.7387	461.59	11.223	0.11640	9.84	0.970	0.028		0.010	<0.004	8.27E-7	8.11E-8		1.06E-8		294186350	
U10.51	1.1300	48.2559	483.67	11.223	0.11640	9.52	0.930	0.211		0.130	0.021	1.33E-6	1.03E-6		2.31E-7	8.02E-8	294186350	
U10.52	1.1300	44.7921	519.63	11.223	0.11640	9.74	0.200	0.189		0.120	0.01	2.66E-7	8.53E-7		1.98E-7	3.54E-8	294186350	
U10.53	1.1300	47.3505	560.52	11.223	0.11640	9.85	1.080	0.236		0.120	0.01	1.52E-6	1.13E-6		2.10E-7	3.75E-8	294186350	
U10.54	1.1300	34.6774	594.67	11.223	0.11640	9.42	1.300	0.142		0.040	0.001	1.34E-6	4.96E-7		5.12E-8	2.74E-8	294186350	
U10.55	1.1300	32.9586	618.69	11.223	0.11640	9.36	2.903	0.406		0.201	0.051	2.84E-6	1.35E-6		2.44E-7	1.33E-7	294186350	
U10.56	1.1300	24.9358	637.64	11.223	0.11640	9.68	0.489	0.415		0.161	0.055	3.62E-7	1.04E-6		1.48E-7	1.09E-7	294186350</	

U10.58	1.1300	17.5982	699.66	11.223	0.11640	9.38	1.869	0.177	<0.1	<0.005	8.72E-7	3.14E-7		294186350	
U10.59	1.1300	46.8771	735.63	11.223	0.11640	9.31	1.257	0.071	0.136	<0.005	1.74E-6	3.34E-7	2.34E-7	294186350	
U10.60	1.1300	40.2839	762.66	11.223	0.11640	9.85	0.710	0.529	0.080	0.01	8.49E-7	2.15E-6	1.19E-7	3.19E-8	294186350
U10.61	1.1300	41.9901	800.61	11.223	0.11640	9.97	0.030	0.491	0.071	0.01	3.74E-8	2.08E-6	1.10E-7	3.32E-8	294186350
U10.62	1.1300	37.8874	827.57	11.223	0.11640	9.94	0.200	0.518	0.062	0.01	2.25E-7	1.98E-6	8.66E-8	3.00E-8	294186350
U10.63	1.1300	48.7004	853.82	11.223	0.11640	9.9	0.510	0.57	0.152	0.01	7.37E-7	2.80E-6	2.73E-7	3.85E-8	294186350
U10.64	1.1300	49.7609	919.19	11.223	0.11640	9.9	0.230	0.491	0.095	0.01	3.40E-7	2.46E-6	1.74E-7	3.94E-8	294186350
U10.65	1.1300	44.1014	967.54	11.223	0.11640	9.82	0.040	0.491	0.059	0.01	5.23E-8	2.18E-6	9.60E-8	3.49E-8	294186350
U10.66	1.1300	45.2232	1010.58	11.223	0.11640	9.56	0.330	0.491	0.058	0.01	4.43E-7	2.24E-6	9.68E-8	3.58E-8	294186350
average		1.13348													
% loss		0.0020													

Pu Dissolution Project (U-Ce-Ca-Tl-Hf samples) pH 12
 Experiments Started on : 2/3/1998 5:00:00 PM
 Experiments Terminated on : 11/9/2000 1:56:00 PM Duration: 1011 days
 Sample: U-Ce-Tl-Ca Ceramic Ceramic sample ID: P133
 Starting SA= 0.1028 m^2/g
 ceramic density 5.19 g/cm^3 5.190E-12 g/m^3
 Element WtFrac Element
 U 0.26
 Ce 0.08 Surface Area Calculation
 Ca 0.09 assume spherical particles
 Ti 0.21 diameter(microns) = 11.246
 Hf 0.10 num.particles/g = 2.58739E+8

Formulas for cell entries
 Net Rate= Concentration(ppb) * 0.000001 * FlowRate(mL/day) *
 0.001*SampleMass(g)/SurfaceArea(m^2/g) Wt.Fraction
 SampleMass= init. wt. - (days elapsed * FlowRate (mL/day) *
 ((ppbU*U_Wt.Fraction)+(ppbCe*Ce_Wt.Fraction)+...))+0.000001
 Diameter= 2* (SampleMass(t)*0.75/Density(g/cu.mic.)*#Particles)^(1/3)
 Note that Initial Diameter is assumed to be the same for all runs.
 Surface Area (m^2/g)= # Particles*4*π*(Diameter(m)/2)^2*10^-12
 # Particles= Sample Mass (g) * # Particles/gram
 # Particles/gram = Surface Area (m^2/g)/(4*π*(Initial Diameter(m)/2)^2)**
 **Value of # Particles/g is kept constant through out a run
 Initial Diameter (um): 2/3/SurfaceArea(10^6 um)^2/g/Density(g/(10^6 um)^3)

0.01m NaOH																		
25 C data	Mass Ceramics	Flow Rate	Run time	Diameter	Surf. Area	pH	U	Ce	Ca	Tl	Hf	NR-U	NR-Ce	NR-Ca	NR-Tl	NR-Hf	#Particles	
pH12-1 start	1.0152		(g)	(g/day)	(days)	(microns)	(m^2/g)	ppb	ppb	ppb	ppb	g/m^2/day	g/m^2/day	g/m^2/day	g/m^2/day	g/m^2/day	262671928	
U12(1).01	1.0152	35.58	0.34	11.246	0.10436	12.06	257.0	<0.07	330.00	<0.2	0.70	3.37E-4	1.28E-3	2.45E-6	2.26E71928			
U12(1).02	1.0152	46.48	0.86	11.246	0.10436	12.10	144.0	<0.07	135.00	<0.2	0.80	2.47E-4	6.86E-4	3.85E-6	2.26E71928			
U12(1).03	1.0152	46.88	1.85	11.246	0.10436	12.16	78.0	<0.07	68.00	<0.2	0.70	1.35E-4	3.49E-4	3.22E-6	2.26E71928			
U12(1).04	1.0152	48.03	5.86	11.246	0.10436	12.09	29.0	<0.07	23.00	<0.2	0.50	5.13E-5	1.21E-4	2.36E-6	2.26E71928			
U12(1).05	1.0152	48.42	7.83	11.246	0.10436	12.17	22.0	<0.07	22.00	<0.2	0.50	3.92E-5	1.16E-4	2.38E-6	2.26E71928			
U12(1).06	1.0152	48.76	9.83	11.246	0.10436	12.01	16.0	<0.07	18.00	<0.2	<0.5	2.87E-5	9.60E-5	2.26E71928				
U12(1).07	1.0152	49.37	13.83	11.246	0.10436	12.03	12.0	<0.07	20.00	<0.2	0.600	2.18E-5	1.08E-4	2.91E-6	2.26E71928			
U12(1).08	1.0152	49.34	15.86	11.246	0.10436	12.12	8.200	0.10	11.00	3.400	0.120	1.49E-5	6.17E-7	5.94E-5	7.58E-6	5.82E-7	2.26E71928	
U12(1).09	1.0152	48.31	20.21	11.246	0.10436	11.90	7.840	0.05	14.00	0.160	0.090	1.41E-5	2.90E-7	7.40E-5	3.54E-7	4.27E-7	2.26E71928	
U12(1).10	1.0152	49.97	23.16	11.246	0.10436	12.03	6.720	0.06	9.00	0.190	0.090	1.24E-5	3.44E-7	4.92E-5	4.35E-7	4.42E-7	2.26E71928	
U12(1).11	1.0152	51.65	27.19	11.246	0.10436	11.90	4.100	0.10			0.080	7.80E-6	6.48E-7	4.06E-7	2.26E71928			
U12(1).12	1.0152	57.20	30.17	11.246	0.10436	12.09	4.800	0.09			0.120	1.01E-5	6.44E-7	6.74E-7	2.26E71928			
U12(1).13	1.0152	61.87	41.22	11.246	0.10436	12.19	2.700	0.07			0.020	6.13E-6	5.40E-7	1.21E-7	2.26E71928			
U12(1).14	1.0152	62.83	44.18	11.246	0.10436	12.11	3.120	0.06			0.120	7.22E-6	4.48E-7	7.41E-7	2.26E71928			
U12(1).15	1.0152	90.22	48.36	11.246	0.10436	11.98	2.340	0.05			0.130	7.78E-6	5.53E-7	1.15E-6	2.26E71928			
U12(1).16	1.0152	107.53	51.08	11.246	0.10436	12.02	1.940	0.05			0.140	7.69E-6	6.05E-7	1.48E-6	2.26E71928			
U12(1).17	1.0152	46.30	55.43	11.246	0.10436	12.03	2.510	0.03			0.100	4.28E-6	1.85E-7	4.55E-7	2.26E71928			
U12(1).18	1.0152	45.97	62.44	11.246	0.10436	11.96	2.170	0.04			0.080	3.68E-6	2.07E-7	3.61E-7	2.26E71928			
U12(1).19	1.0152	45.81	71.14	11.246	0.10436	12.03	1.760	0.04			0.080	2.97E-6	2.06E-7	3.60E-7	2.26E71928			
U12(1).20	1.0152	46.16	75.84	11.246	0.10436	12.09	1.560	<0.009	22.00	<0.1	0.020	2.65E-6	1.11E-4	9.07E-8	2.26E71928			
U12(1).21	1.0152	45.94	83.32	11.246	0.10436	12.06	1.700	<0.009	17.00	0.130	0.030	2.88E-6	8.54E-5	2.74E-7	1.35E-7	2.26E71928		
U12(1).22	1.0152	84.66	90.85	11.246	0.10436	12.06	1.330	0.01	18.00	0.180	0.050	4.15E-6	1.17E-7	1.67E-4	6.98E-7	4.16E-7	2.26E71928	
U12(1).23	1.0152	85.93	96.84	11.246	0.10436	11.90	1.080	<0.009	12.000	0.180	0.090	3.42E-6	1.13E-4	7.08E-7	7.60E-7	2.26E71928		
U12(1).24	1.0152	85.80	103.84	11.246	0.10436	12.12	0.970	0.01	11.000	0.150	0.050	3.07E-6	1.40E-7	1.03E-4	5.89E-7	4.21E-7	2.26E71928	
U12(1).25	1.0152	89.66	119.24	11.246	0.10436	12.14	1.020	0.01	30.000	0.180	0.080	3.37E-6	1.46E-7	2.94E-4	7.39E-7	7.05E-7	2.26E71928	
U12(1).26	1.0152	88.96	125.04	11.246	0.10436	12.17	1.010	0.01	3.000	0.170	0.060	3.31E-6	1.22E-7	2.92E-5	6.93E-7	5.24E-7	2.26E71928	
U12(1).27	1.0152	91.47	139.16	11.246	0.10436	12.23	0.780	0.01	3.000	0.170	0.023	2.83E-6	1.14E-7	3.00E-5	7.12E-7	2.07E-7	2.26E71928	
U12(1).28	1.0152	98.31	146.16	11.246	0.10436	12.15	0.930	0.02	5.000	0.170	0.026	2.96E-6	2.16E-7	4.72E-5	6.72E-7	2.20E-7	2.26E71928	
U12(1).29	1.0152	82.82	153.15	11.246	0.10436	11.91	0.960	0.03	5.000	0.170	0.019	2.93E-6	3.11E-7	4.53E-5	6.45E-7	1.55E-7	2.26E71928	
U12(1).30	1.0152	83.39	162.13	11.246	0.10436	11.91	1.050	0.03	4.000	0.230	0.021	3.23E-6	3.13E-7	3.65E-5	8.78E-7	1.72E-7	2.26E71928	
U12(1).31	1.0152	82.20	168.64	11.246	0.10436	12.13	0.940	0.02	6.000	0.170	0.032	2.85E-6	2.06E-7	5.39E-5	6.40E-7	2.58E-7	2.26E71928	
U12(1).32	1.0152	82.65	175.66	11.246	0.10436	12.13	0.790	0.02	2.000	0.190	0.004	2.41E-6	2.07E-7	1.81E-5	7.19E-7	3.25E-8	2.26E71928	
U12(1).33	1.0152	50.14	183.63	11.246	0.10436	11.44											2.26E71928	
U12(1).34	1.0152	49.00	195.62	11.246	0.10436	10.94	0.685	nd			nd	nd	1.24E-6					2.26E71928
U12(1).35	1.0152	48.97	209.81	11.246	0.10436	9.65												2.26E71928
U12(1).36	1.0152	48.95	223.68	11.246	0.10436	12.13	2.437	0.02			nd	0.049	4.39E-6	9.19E-8		2.36E-7		2.26E71928
U12(1).37	1.0152	49.70	238.66	11.246	0.10436	12.09												2.26E71928
U12(1).38	1.0152	49.80	251.69	11.246	0.10436	12.10	1.089	nd			nd	0.029	2.00E-6			1.42E-7		2.26E71928
U12(1).39	1.0152	50.07	265.67	11.246	0.10436	12.03												2.26E71928
U12(1).40	1.0152	49.42	281.59	11.246	0.10436	11.95	0.768	nd			nd	0.023	1.40E-6			1.12E-7		2.26E71928
U12(1).41	1.0152	49.76	289.64	11.246	0.10436	11.98												2.26E71928

U12(1).42	1.0152	49.43	301.66	11.246	0.10436	11.85	0.690	0.04	0.136	0.034	1.26E-6	2.35E-7	3.08E-7	1.65E-7	262671928
U12(1).43	1.0152	48.96	307.64	11.246	0.10436	11.96									262671928
U12(1).44	1.0152	49.03	315.64	11.246	0.10436	12.00	0.580	0.01	0.092	0.019	1.01E-6	8.59E-8	2.07E-7	9.15E-8	262671928
U12(1).45	1.0152	50.16	335.73	11.246	0.10436	11.93	0.610	0.02	0.076	0.019	1.13E-6	9.42E-8	1.75E-7	9.38E-8	262671928
U12(1).46	1.0152	49.15	357.64	11.246	0.10436	11.92	0.470	0.02	0.078	0.009	8.51E-7	1.05E-7	1.76E-7	4.34E-6	262671928
U12(1).47	1.0152	48.78	379.64	11.246	0.10436	11.96	0.420	0.02	0.118	0.007	7.55E-7	9.77E-8	2.64E-7	3.35E-8	262671928
U12(1).48	1.0152	50.04	406.65	11.246	0.10436	11.89	0.420	0.01	0.098	0.009	7.74E-7	8.14E-8	2.25E-7	4.42E-8	262671928
U12(1).49	1.0152	50.48	428.67	11.246	0.10436	11.98	0.430	0.01	0.089	0.009	8.00E-7	8.95E-8	2.06E-7	4.46E-8	262671928
U12(1).50	1.0152	49.07	461.59	11.246	0.10436	11.95	0.560	<0.009	0.098	0.016	1.01E-6		2.20E-7	7.71E-8	262671928
U12(1).51	1.0152	56.42	483.67	11.246	0.10436	11.82	0.380	<0.009	0.101	0.006	7.90E-7		2.61E-7	3.32E-8	262671928
U12(1).52	1.0152	49.43	519.63	11.246	0.10436	11.90	0.480	0.01	0.086	0.011	8.74E-7	6.80E-8	1.95E-7	5.34E-8	262671928
U12(1).53	1.0152	64.16	560.52	11.246	0.10436	12.03	0.320	<0.009	0.124	0.022	7.58E-7		3.64E-7	1.39E-7	262671928
U12(1).54	1.0152	59.75	594.67	11.246	0.10436	12.03	0.380	<0.009	0.105	0.024	8.36E-7		2.87E-7	1.41E-7	262671928
U12(1).55	1.0152	54.75	618.89	11.246	0.10436	12.14	0.574	nd	nd	0.033	1.16E-6		1.77E-7		262671928
U12(1).56	1.0152	56.55	637.64	11.246	0.10436	11.95	0.481	nd	nd	0.029	1.00E-6		1.61E-7		262671928
U12(1).57	1.0152	55.84	678.52	11.246	0.10436	11.70	0.387	nd	nd	nd	7.93E-7				262671928
U12(1).58	1.0152	54.87	699.66	11.246	0.10436	11.85	0.378	nd	nd	nd	7.84E-7				262671928
U12(1).59	1.0152	54.96	735.83	11.246	0.10436	11.90	0.458	nd	nd	0.006	9.27E-7		3.24E-8		262671928
U12(1).60	1.0152	54.63	762.86	11.246	0.10436	11.88	0.450	0.005	0.031	0.010	9.06E-7	3.42E-8	7.76E-8	5.37E-8	262671928
U12(1).61	1.0152	56.31	800.61	11.246	0.10436	12.12	0.580	0.009	0.035	0.020	1.20E-6	6.34E-8	9.03E-8	1.11E-7	262671928
U12(1).62	1.0152	54.06	827.57	11.246	0.10436	10.09	0.450	0.005	0.035	0.020	8.96E-7	3.38E-8	8.66E-8	1.06E-7	262671928
U12(1).63	1.0152	52.94	853.82	11.246	0.10436	12.26	0.410	0.005	0.036	0.020	8.00E-7	3.31E-8	8.73E-8	1.04E-7	262671928
U12(1).64	1.0152	55.35	919.19	11.246	0.10436	12.26	0.320	0.005	0.040	0.020	6.53E-7	3.46E-8	1.01E-7	1.09E-7	262671928
U12(1).65	1.0152	53.01	967.54	11.246	0.10436	12.08	0.340	0.004	0.038	0.020	6.84E-7	2.65E-8	9.23E-8	1.04E-7	262671928
U12(1).66	1.0152	51.23	1010.58	11.246	0.10436	11.98	0.280	0.004	0.036	0.010	5.28E-7	2.56E-8	8.45E-8	5.03E-8	262671928
average		1.0152													
% loss		0.0025													

0.005m Na₂CO₃+0.01m NaOH

25 C data	Mass Ceramics	Flow Rate	Run time	Diameter	Surf. Area	pH	U	Ce	Ca	Ti	Hf	NR-U	NR-Ce	NR-Ca	NR-Ti	NR-Hf	#Particles		
pH 12-2	(g)	(mL/day)	(days)	(microns)	(sq. m)	ppb	ppb	ppb	ppb	ppb	ppb	g/m^2/day	g/m^2/day	g/m^2/day	g/m^2/day	g/m^2/day	283500425		
	start	1.0957		0.00	11.246	0.11264	11.99	ppb	ppb	ppb	ppb	<0.07	393.000	<0.2	<0.5	1.43E-4	1.25E-3		
U12(2).01	1.0957	33.84	0.34	11.246	0.11264	11.99	134.000	<0.07	221.000	<0.2	<0.5	9.45E-5	8.98E-4				283500425		
U12(2).02	1.0957	43.30	0.86	11.246	0.11264	12.18	69.000	<0.07	142.000	<0.2	<0.5	4.96E-5	5.81E-4				283500425		
U12(2).03	1.0957	43.61	1.85	11.246	0.11264	12.10	36.000	<0.07	70.000	<0.2	<0.5	1.76E-5	2.82E-4				283500425		
U12(2).04	1.0957	42.91	5.86	11.246	0.11264	12.14	13.000	<0.07	31.000	<0.2	<0.5	1.33E-5	1.24E-4				283500425		
U12(2).05	1.0957	42.62	7.83	11.246	0.11264	12.12	9.900	<0.07	47.000	<0.2	<0.5	1.05E-5	1.88E-4				283500425		
U12(2).06	1.0957	42.21	9.83	11.246	0.11264	12.02	7.900	<0.07	34.000	<0.2	<0.5	7.87E-6	1.35E-4				283500425		
U12(2).07	1.0957	42.19	13.83	11.246	0.11264	12.03	5.900	<0.07	18.00	2.400	0.110	1.28E-5	3.17E-7	6.34E-5	3.98E-6	3.91E-7	283500425		
U12(2).08	1.0957	42.19	15.86	11.246	0.11264	12.06	9.600	0.07	16.00	2.400	0.090	1.55E-5	7.40E-5	4.45E-7	3.74E-7	283500425			
U12(2).09	1.0957	49.24	20.21	11.246	0.11264	11.90	9.980	<0.009	16.00	0.230	0.090	1.96E-4	3.98E-7	4.29E-7	3.80E-7		283500425		
U12(2).10	1.0957	47.39	23.16	11.246	0.11264	11.97	9.990	<0.009	89.00	0.230	0.090	1.50E-5					283500425		
U12(2).11	1.0957	48.48	27.19	11.246	0.11264	11.88	4.900	0.06			0.120	7.51E-6	3.12E-7			4.91E-7	283500425		
U12(2).12	1.0957	35.79	30.17	11.246	0.11264	12.05	5.700	0.08			0.110	6.45E-6	3.08E-7			3.32E-7	283500425		
U12(2).13	1.0957	36.22	41.22	11.246	0.11264	12.13	4.200	0.07			0.060	4.81E-6	2.72E-7			1.83E-7	283500425		
U12(2).14	1.0957	36.53	44.18	11.246	0.11264	12.03	5.550	0.03			0.150	6.41E-6	1.02E-7			4.62E-7	283500425		
U12(2).15	1.0957	57.80	48.36	11.246	0.11264	11.98	9.180	0.02			<0.02	1.68E-5	1.24E-7				283500425		
U12(2).16	1.0957	43.64	51.08	11.246	0.11264	12.00	5.050	0.02			0.150	6.97E-6	8.91E-8			5.52E-7	283500425		
U12(2).17	1.0957	41.56	55.43	11.246	0.11264	12.01	4.430	0.02			0.160	5.82E-6	1.07E-7			5.61E-7	283500425		
U12(2).18	1.0957	40.85	62.44	11.246	0.11264	11.91	3.970	0.02			0.130	5.13E-6	7.87E-8			4.48E-7	283500425		
U12(2).19	1.0957	40.31	71.14	11.246	0.11264	12.02	3.430	0.02			0.130	4.37E-6	7.79E-8			4.42E-7	283500425		
U12(2).20	1.0957	40.40	75.84	11.246	0.11264	12.08	3.590	0.01	9.00	0.110	0.100	4.59E-6	5.84E-8	3.41E-5	1.75E-7	3.41E-7	283500425		
U12(2).21	1.0957	40.24	83.32	11.246	0.11264	12.06	3.400	0.01	12.00	0.100	0.090	4.33E-6	5.19E-8	4.53E-5	1.58E-7	3.05E-7	283500425		
U12(2).22	1.0957	45.11	90.85	11.246	0.11264	12.00	2.940	0.01	10.00	0.180	0.090	4.19E-6	5.33E-8	4.24E-5	3.19E-7	3.42E-7	283500425		
U12(2).23	1.0957	71.58	96.84	11.246	0.11264	11.90	2.260	0.01	9.00	0.170	0.130	5.12E-6	7.89E-8	6.05E-5	4.78E-7	7.85E-7	283500425		
U12(2).24	1.0957	71.12	103.84	11.246	0.11264	12.12	2.040	0.01	11.00	0.140	0.080	4.59E-6	6.88E-8	7.35E-5	3.91E-7	4.80E-7	283500425		
U12(2).25	1.0957	70.08	119.24	11.246	0.11264	12.11	1.820	0.01	12.00	0.170	0.110	4.03E-6	6.78E-8	7.90E-5	4.68E-7	8.50E-7	283500425		
U12(2).26	1.0957	68.87	125.04	11.246	0.11264	12.15	1.750	<0.009	11.00	0.080	0.080	3.82E-6		7.12E-5	2.17E-7	4.65E-7	283500425		
U12(2).27	1.0957	69.11	139.16	11.246	0.11264	12.17	1.390	0.01	6.00	0.220	0.018	3.04E-6	7.42E-8	3.89E-5	5.98E-7	1.05E-7	283500425		
U12(2).28	1.0957	67.97	146.16	11.246	0.11264	12.14	1.410	0.01	9.00	0.210	0.010	3.03E-6	7.30E-8	5.74E-5	5.81E-7	5.73E-8	283500425		
U12(2).29	1.0957	66.50	153.15	11.246	0.11264	12.02	1.440	0.01	9.00	0.200	0.024	3.03E-6	7.14E-8	5.82E-5	5.23E-7	1.35E-7	283500425		
U12(2).30	1.0957	66.61	182.13	11.246	0.11264	12.02	1.410	0.01	9.00	0.240	0.012	2.97E-6	7.16E-8	5.63E-5	6.29E-7	6.74E-8	283500425		
U12(2).31	1.0957	64.97	168.64	11.246	0.11264	12.04	1.330	0.01	11.00	0.220	0.021	2.73E-6	6.98E-8	6.71E-5	5.62E-7	1.15E-7	283500425		
U12(2).32	1.0957	65.00	175.66	11.246	0.11264	12.29	1.290	0.01	10.00	0.240	nd	2.85E-6	6.98E-8	6.10E-5	6.13E-7		283500425		
U12(2).33	1.0957	39.82	183.83	11.246	0.11264	11.44											283500425		
U12(2).34	1.0957	44.17	195.62	11.246	0.11264	11.10	1.715	0.02			nd		2.40E-6	1.04E-7			283500425		
U12(2).35	1.0957	43.86	209.81	11.246	0.11264	10.86					nd						283500425		
U12(2).36	1.0957	44.06	223.68	11.246	0.11264	12.16	2.357	0.01			nd	0.074	3.28E-6	4.26E-8		2.75E-7	283500425		
U12(2).37	1.0957	43.78	238.66	11.246	0.11264	12.06					nd						283500425		
U12(2).38	1.0957	44.48	251.69	11.246	0.11264	12.19	1.796	0.01			nd		0.056	2.53E-6	4.30E-8		2.10E-7	283500425	
U12(2).39	1.0957	44.09	265.87	11.246	0.11264	12.23					nd						283500425		
U12(2).40	1.0957	43.96	281.59	11.246	0.11264	12.09	1.283	0.01			nd		0.040	1.78E-6	3.78E-8		1.48E-7	283500425	
U12(2).41	1.0957	40.00	289.64	11.246	0.11264	11.95											283500425		
U12(2).42	1.0957	28.64	301.86	11.246	0.11264	11.89	1.380	<0.009			0.085		0.032	1.25E-6		9.57E-8	7.73E-8	283500425	
U12(2).43	1.0957	24.47	307.64	11.246	0.11264	11.94					nd		0.075	0.022	1.01E-6			283500425	
U12(2).44	1.0957	21.86	315.84	11.246	0.11264	11.90	1.460	<0.009			nd		0.068	0.021	9.84E-7		6.45E-8	4.06E-8	283500425
U12(2).45	1.0957	17.82	335.73	11.246	0.11264	11.92	1.710	<0.009			nd		0.066	0.012	1.83E-6	7.97E-7	4.77E-8	3.16E-8	283500425
U12(2).46	1.0957	38.84	357.64	11.246	0.11264	11.98	1.490	0.19			nd		0.469	0.159	1.83E-6	7.97E-7	7.16E-7	5.21E-7	283500425
U12(2).47	1.0957	20.63	379.64	11.246	0.11264	11.94	1.450	<0.009			nd		0.066	0.023	9.46E-7		5.35E-8	4.00E-8	283500425
U12(2).48	1.0957	14.41	408.65	11.246	0.11264	11.86												283500425	
U12(2).49	1.0957	13.62	428.67	11.246	0.11264	11.98	2.560	<0.009			0.058		0.023	1.10E-6			3.11E-8	2.64E-8	283500425
U12(2).50	1.0957	42.82	461.59	11.246	0.11264	11.96	1.460	0.14			0.417		0.097	1.98E-6	6.30E-7		7.02E-7	3.50E-7	283500425
U12(2).51	1.0957	46.16	483.67	11.246	0.11264	11.89	0.730	<0.009			0.100		0.024	1.07E-6			1.81E-7	9.34E-8	283500425
U12(2).52	1.0957	44.54	519.63	11.246	0.11264	11.93	1.220	<0.009			0.116		0.029	1.72E-6			2.03E-7	1.09E-7	283500425
U12(2).53	1.0957	64.68	560.52	11.246	0.11264	12.01	1.130	<0.009			0.098		0.043	2.31E-6			2.49E-7	2.34E-7	283500425
U12(2).54	1.0957	59.16	594.87	11.246	0.11264	11.90	1.170	<0.009			0.062		0.012	2.19E-6			1.44E-7	5.99E-8	283500425
U12(2).55	1.0957	54.60	618.69	11.246	0.11264	12.00	1.161	0.00			nd		0.029	2.01E-6	1.76E-8		1.34E-7	283500425	
U12(2).56	1.0957	58.64	637.64	11.246	0.11264	11.92	1.323	0.00		</									

U12(2).58	1.0957	53.75	699.66	11.246	0.11264	11.85	1.106	0.00	nd	0.010	1.88E-8	5.77E-9		4.53E-8	283500425	
U12(2).59	1.0957	53.83	735.63	11.246	0.11264	11.93	1.185	0.00	nd	0.017	2.01E-8	5.78E-9		7.69E-8	283500425	
U12(2).60	1.0957	52.52	762.66	11.246	0.11264	11.80	1.310	0.010	0.078	0.020	2.18E-8	5.84E-8		1.81E-7	8.86E-8	283500425
U12(2).61	1.0957	53.60	800.81	11.246	0.11264	11.90	1.420	0.006	0.054	0.020	2.41E-8	3.45E-8		1.14E-7	9.04E-8	283500425
U12(2).62	1.0957	51.13	827.57	11.246	0.11264	11.96	0.800	0.006	0.060	0.020	1.29E-8	3.30E-8		1.21E-7	8.62E-8	283500425
U12(2).63	1.0957	49.61	853.62	11.246	0.11264	12.08	0.820	0.005	0.056	0.020	1.29E-8	2.66E-8		1.09E-7	8.37E-8	283500425
U12(2).64	1.0957	50.50	919.19	11.246	0.11264	12.08	0.890	0.007	0.051	0.020	1.42E-8	3.80E-8		1.01E-7	8.52E-8	283500425
U12(2).65	1.0957	47.78	967.54	11.246	0.11264	12.06	0.870	0.523	0.055	0.040	1.31E-8	2.68E-8		1.03E-7	1.61E-7	283500425
U12(2).66	1.0957	44.30	1010.58	11.246	0.11264	11.97	0.700	0.066	0.097	0.020	9.81E-7	3.14E-7		1.69E-7	7.47E-8	283500425
average		1.0957														
% loss		0.0025														

0.0025m K ₂ HPO ₄ +0.0075 NaOH																		
25 C data	Mass	Ceramics	Flow Rate	Run time	Diameter	Surf. Area	pH	U	Ce	Ca	Tl	Hf	NR-U	NR-Ce	NR-Ca	NR-Tl	NR-Hf	#Particles
pH 12-3	(g)	(mL/day)	(days)	(microns)	(sq. m)		ppb	ppb	ppb	ppb	ppb	ppb	g/m^2/day	g/m^2/day	g/m^2/day	g/m^2/day	g/m^2/day	
start	1.0094		0.00	11.246	0.10377	11.97	509.000	<0.07	336.000	<0.2	1.300	3.93E-4	7.71E-4	1.20E-3	2.68E-6	5.28E-6	261171241	
U12(3).01	1.0094	20.74	0.34	11.246	0.10377	11.87	202.000	<0.07	246.000	<0.2	1.200	3.33E-4	7.10E-4	1.05E-3	2.35E-6	5.08E-6	261171241	
U12(3).02	1.0094	44.26	0.86	11.2458	0.1038	12.13	67.000	<0.07	85.000	<0.2	1.100	1.40E-4	3.28E-4	5.28E-4	6.13E-6	4.50E-6	261171241	
U12(3).03	1.0094	56.14	1.85	11.2458	0.1038	12.07	21.000	<0.07	22.000	<0.2	0.800	4.43E-5	1.38E-4	2.05E-4	5.28E-6	261171241		
U12(3).04	1.0094	56.84	5.86	11.2458	0.1038	12.10	22.000	<0.07	26.000	<0.2	0.900	4.84E-5	1.70E-4	2.40E-4	5.28E-6	261171241		
U12(3).05	1.0094	59.07	7.83	11.2458	0.1038	12.08	20.000	<0.07	20.000	<0.2	1.200	2.83E-5	-	1.40E-4	7.54E-6	261171241		
U12(3).06	1.0094	63.25	9.83	11.2458	0.1038	12.01	12.000	<0.07	22.000	<0.2	1.400	2.24E-5	-	1.68E-4	9.63E-6	261171241		
U12(3).07	1.0094	69.23	13.83	11.2458	0.1038	12.06	8.700	<0.07	29.00	<0.2	<0.02	1.37E-5	8.96E-7	2.27E-4	-	261171241		
U12(3).08	1.0094	70.77	15.86	11.2458	0.1038	12.07	5.200	0.10	6.00	2.900	<0.02	1.08E-5	3.95E-7	2.65E-5	5.37E-6	261171241		
U12(3).09	1.0094	39.97	20.21	11.2458	0.1038	11.85	7.130	0.08	27.00	0.410	<0.02	9.58E-6	2.85E-7	1.10E-4	7.01E-7	261171241		
U12(3).10	1.0094	36.92	23.16	11.2458	0.1038	11.99	6.960	0.06	0.400	<0.02	6.32E-6	5.60E-7	0.00E+0	6.83E-7	-	261171241		
U12(3).11	1.0094	36.85	27.19	11.2458	0.1038	11.89	4.600	0.12	-	-	-	-	-	-	-	4.78E-7	261171241	
U12(3).12	1.0094	50.12	30.17	11.2458	0.1038	12.00	3.600	0.11	-	-	-	-	-	-	-	6.72E-6	261171241	
U12(3).13	1.0094	41.75	41.22	11.2458	0.1038	11.86	2.600	0.09	-	-	-	-	-	-	-	4.05E-6	4.76E-7	9.95E-7
U12(3).14	1.0094	53.34	44.18	11.2458	0.1038	11.90	3.270	0.05	-	-	-	-	-	-	-	6.50E-6	3.51E-7	2.65E-7
U12(3).15	1.0094	68.39	48.36	11.2458	0.1038	11.58	2.900	0.06	-	-	-	-	-	-	-	0.070	7.39E-6	5.37E-7
U12(3).16	1.0094	47.28	51.08	11.2458	0.1038	11.85	2.630	0.10	-	-	-	-	-	-	-	4.63E-6	5.88E-7	261171241
U12(3).17	1.0094	44.97	55.43	11.2458	0.1038	11.86	2.880	0.08	-	-	-	-	-	-	-	4.49E-6	4.87E-7	261171241
U12(3).18	1.0094	44.14	62.44	11.2458	0.1038	11.78	2.410	0.08	-	-	-	-	-	-	-	3.98E-6	4.19E-7	261171241
U12(3).19	1.0094	43.29	71.14	11.2458	0.1038	11.85	1.920	0.07	-	-	-	-	-	-	-	3.10E-6	3.95E-7	261171241
U12(3).20	1.0094	43.09	75.84	11.2458	0.1038	11.80	1.940	0.05	3.00	-	0.020	3.12E-6	2.56E-7	1.43E-5	-	8.56E-6	261171241	
U12(3).21	1.0094	43.01	83.32	11.2458	0.1038	11.88	1.730	0.04	32.00	0.260	<0.02	2.77E-6	2.29E-7	1.52E-4	5.18E-7	-	261171241	
U12(3).22	1.0094	77.80	90.85	11.2458	0.1038	11.84	1.340	0.03	5.00	0.220	0.100	3.89E-6	2.88E-7	4.30E-5	7.93E-7	7.73E-7	261171241	
U12(3).23	1.0094	77.58	96.84	11.2458	0.1038	11.67	1.120	0.03	6.00	0.240	<0.02	3.24E-6	2.95E-7	5.15E-5	8.82E-7	-	261171241	
U12(3).24	1.0094	76.96	103.84	11.2458	0.1038	11.91	1.100	0.04	3.00	0.170	0.030	3.15E-6	3.51E-7	2.55E-5	6.06E-7	2.29E-7	261171241	
U12(3).25	1.0094	70.34	119.24	11.2458	0.1038	11.85	0.990	0.03	5.00	0.190	<0.02	2.60E-6	2.94E-7	3.89E-6	6.19E-7	-	261171241	
U12(3).26	1.0094	89.41	125.04	11.2458	0.1038	11.98	-	0.01	4.00	0.190	-	0.00E+0	8.79E-8	3.07E-5	6.11E-7	-	261171241	
U12(3).27	1.0094	73.48	139.16	11.2458	0.1038	12.01	0.084	0.03	11.00	0.360	nd	2.30E-7	2.79E-7	8.94E-5	1.23E-6	-	261171241	
U12(3).28	1.0094	71.47	146.16	11.2457	0.1038	11.96	0.078	0.03	9.00	0.380	nd	2.02E-7	2.71E-7	7.12E-5	1.26E-6	-	261171241	
U12(3).29	1.0094	60.09	153.15	11.2457	0.1038	11.83	0.072	0.03	5.00	0.360	0.001	1.81E-7	2.28E-7	3.32E-5	1.00E-6	5.97E-9	261171241	
U12(3).30	1.0094	87.27	162.13	11.2457	0.1038	11.83	0.080	0.03	4.00	0.340	0.002	1.50E-7	2.55E-7	2.98E-5	1.06E-6	1.34E-8	261171241	
U12(3).31	1.0094	58.02	168.84	11.2457	0.1038	11.88	0.068	0.03	2.00	0.370	0.002	1.47E-7	2.20E-7	1.28E-5	9.94E-7	1.15E-8	261171241	
U12(3).32	1.0094	57.17	175.66	11.2457	0.1038	12.06	0.064	0.03	-	0.380	0.003	1.36E-7	2.17E-7	-	1.01E-6	1.70E-8	261171241	
U12(3).33	1.0094	39.23	183.63	11.2457	0.1038	11.23	-	-	-	-	-	-	-	-	-	-	261171241	
U12(3).34	1.0094	40.90	195.62	11.2457	0.1038	10.86	0.448	nd	-	-	-	nd	nd	8.83E-7	-	-	261171241	
U12(3).35	1.0094	43.08	209.81	11.2457	0.1038	10.52	-	-	-	-	-	nd	nd	0.00E+0	-	-	261171241	
U12(3).36	1.0094	42.65	223.68	11.2457	0.1038	11.91	0.891	nd	-	0.296	0.035	1.42E-6	-	5.85E-7	1.48E-7	-	261171241	
U12(3).37	1.0094	40.80	238.66	11.2457	0.1038	11.85	-	-	-	-	-	-	-	-	-	6.57E-7	261171241	
U12(3).38	1.0094	40.29	251.89	11.2457	0.1038	11.90	0.841	nd	-	0.186	nd	1.26E-6	-	3.47E-7	-	-	261171241	
U12(3).39	1.0094	39.10	285.67	11.2457	0.1038	11.92	-	-	-	-	-	-	-	-	-	-	261171241	
U12(3).40	1.0094	38.08	281.58	11.2457	0.1038	11.73	0.509	nd	-	0.086	nd	7.22E-7	-	1.52E-7	-	-	261171241	
U12(3).41	1.0094	37.48	289.84	11.2457	0.1038	11.83	-	-	-	-	-	-	-	-	-	-	261171241	
U12(3).42	1.0094	36.99	301.66	11.2457	0.1038	11.76	0.430	0.02	-	0.300	0.011	5.93E-7	1.12E-7	5.14E-7	4.04E-8	-	261171241	
U12(3).43	1.0094	36.56	307.64	11.2457	0.1038	11.84	-	-	-	-	-	-	-	-	-	-	261171241	
U12(3).44	1.0094	36.89	315.84	11.2457	0.1038	11.85	0.450	0.02	-	0.250	0.012	6.15E-7	1.07E-7	4.25E-7	4.37E-8	-	261171241	
U12(3).45	1.0094	36.77	335.73	11.2457	0.1038	11.80	0.360	0.02	-	0.280	0.017	4.93E-7	9.77E-8	4.77E-7	6.21E-8	-	261171241	
U12(3).46	1.0094	42.48	357.64	11.2457	0.1038	11.78	0.530	0.12	-	0.570	<0.005	8.39E-7	6.51E-7	1.12E-6	-	-	261171241	
U12(3).47	1.0094	44.38	379.84	11.2457	0.1038	11.86	0.290	0.02	-	0.290	<0.005	4.80E-7	1.29E-7	5.96E-7	-	-	261171241	
U12(3).48	1.0094	45.73	406.85	11.2457	0.1038	11.89	0.230	0.02	-	0.310	<0.005	3.92E-7	1.27E-7	6.57E-7	-	-	261171241	
U12(3).49	1.0094	46.04	428.87	11.2457	0.1038	11.90	0.260	0.02	-	0.300	<0.005	4.46E-7	1.22E-7	6.40E-7	-	-	261171241	
U12(3).50	1.0094	47.92	461.59	11.2457	0.1038	12.04	0.570	0.02	-	0.450	<0.005	1.02E-6	1.03E-7	9.99E-7	-	-	261171241	
U12(3).51	1.0094	48.12	483.67	11.2457	0.1038	11.99	0.230	0.02	-	0.410	<0.005	4.12E-7	1.18E-7	9.14E-7	-	-	261171241	
U12(3).52	1.0094	50.63	519.63	11.2457	0.1038	12.09	0.250	0.03	-	0.540	0.053	4.72E-7	1.60E-7	1.27E-6	2.67E-7	-	261171241	
U12(3).53	1.0094	58.16	560.52	11.2457	0.1038	12.15	0.140	0.02	-	0.560	0.029	3.03E-7	1.25E-7	1.51E-6	1.88E-7	-	261171241	
U12(3).54	1.0094	51.11	594.67	11.2457	0.1038	11.82	0.120	0.01	-	0.210	0.017	2.29E-7	7.12E-8	4.97E-7	8.63E-8	-	261171241	
U12(3).55	1.0094	80.12	618.69	11.2457	0.1038	11.80	0.148	nd	-	nd	nd	4.42E-7	-	-	-	-	261171241	
U12(3).56	1.0094	50.58	637.64	11.2457	0.1038	11.56	0.139	nd	-	nd	nd	2.62E-7	-	-	-	-	261171241	
U12(3).57	1.0094	47.53	678.52	11.2457	0.1038	11.56	0.133	nd	-	nd	nd	2.38E-7	-	-	-	-	261171241	

U12(3).58	1.0094	45.98	899.66	11.2457	0.1038	11.75	0.126	nd	0.092	nd	2.16E-7	1.96E-7	261171241		
U12(3).59	1.0094	40.33	735.63	11.2457	0.1038	11.87	0.136	nd	0.104	nd	2.04E-7	1.94E-7	261171241		
U12(3).60	1.0094	41.69	762.66	11.2457	0.1038	11.88	0.350	0.01	0.069	0.030	5.44E-7	6.86E-8	1.33E-7	1.24E-7	261171241
U12(3).61	1.0094	43.43	800.61	11.2457	0.1038	11.83	0.170	0.01	0.066	0.020	2.75E-7	7.70E-8	1.33E-7	8.63E-8	261171241
U12(3).62	1.0094	42.79	827.57	11.2457	0.1038	11.86	0.150	0.02	0.081	0.020	2.39E-7	9.21E-8	1.61E-7	8.50E-8	261171241
U12(3).63	1.0094	50.23	853.62	11.2457	0.1038	12.02	0.130	0.02	0.056	0.020	2.43E-7	1.34E-7	1.30E-7	9.98E-8	261171241
U12(3).64	1.0094	38.89	919.19	11.2457	0.1038	12.02	0.100	0.36	0.059	0.010	1.45E-7	1.77E-6	1.06E-7	3.86E-8	261171241
U12(3).65	1.0094	37.63	967.54	11.2457	0.1038	12.01	0.090	0.01	0.068	0.030	1.26E-7	3.81E-8	1.19E-7	1.12E-7	261171241
U12(3).66	1.0094	43.71	1010.58	11.2457	0.1038	11.91	0.110	0.01	0.099	0.040	1.79E-7	6.09E-8	2.00E-7	1.74E-7	261171241
average	1.0094														
% loss	0.0017														

Appendix C

Pu Ce-U Single Phase Zirconolite

Pu Dissolution Project (U-Ce-Ca-Ti-Hf-Gd samples) pH 2-12
 Experiments Started on : 8/4/1998 10:00:00 PM
 Experiments Terminated on : 12/3/1998 8:45:00 AM

Zirconolite

Duration: 121 days

Ce-Ti-Ca-Gd Ceramic P139

Starting SA= 0.32 m^2/g
 ceramic densi: 6.2 g/cm^3 Sample: U-Ce-Ti-Ca Ceramic
 6.200E-12 g/μ^3

Element	iFrac Element	Surface Area Calculation assume spherical particles		
U	0.1423			
Ce	0.0519			
Ca	0.0692	diameter(microns) =	3.02	
Ti	0.2128	num.particles/g =	1.1137E+10	
Hf	0.2153			
Gd	0.0600			

0.7515

25 C data pH 2	Mass Ceramics (g)	Flow Rate (mL/day)	Run time (days)	Diameter (microns)	Surf. Area (sq. m)	pH	corrected for dilution and BLANKS IF APPLICABLE (Gd and Hf data)												#Particles	
							Ca	Ti	Ce	Gd	Hf	U	NR-Ca	NR-Ti	NR-Ce	NR-Gd	NR-Hf	NR-U		
start	1.0035		82.75	3.0217	0.32139		ppb	ppb	ppb	ppb	ppb	ppb	1.84E-6	9.62E-7	1.12E-6	1.1204E+10				
S07-40-25	1.0035	48.20	84.91	3.0217	0.32139	1.84		2.6065		0.3849	1.6024								1.1204E+10	
S07-41-25	1.0035	49.59	86.99	3.0217	0.32139	1.90				0.2953	0.9035								1.1204E+10	
S07-42-25	1.0035	50.32	91.01	3.0217	0.32139	1.84				0.2689	0.5029								1.1204E+10	
S07-43-25	1.0035	50.35	93.96	3.0217	0.32139	1.95				0.2770	0.5917								1.1204E+10	
S07-44-25	1.0035	49.93	100.89	3.0217	0.32139	1.94					0.6238								1.1204E+10	
S07-45-25	1.0035	99.80	106.00	3.0217	0.32139	1.78					0.3990								5.75E-7	1.1204E+10
S07-46-25	1.0035	102.75	112.81	3.0217	0.32138	1.82					0.3347								4.97E-7	1.1204E+10
S07-47-25	1.0035	101.90	120.89	3.0217	0.32138	2.12					0.3512								5.17E-7	1.1204E+10
																			1.1204E+10	

25 C data pH 4	Mass Ceramics (g)	Flow Rate (mL/day)	Run time (days)	Diameter (microns)	Surf. Area (sq. m)	pH	corrected for dilution and BLANKS IF APPLICABLE (Gd and Hf data)												#Particles			
							Ca	Ti	Ce	Gd	Hf	U	NR-Ca	NR-Ti	NR-Ce	NR-Gd	NR-Hf	NR-U				
start	1.0030		82.75	3.0222	0.32096		ppb	ppb	ppb	ppb	ppb	ppb	6.8178	4.4016	1.6983	1.97E-5	1.10E-5	1.79E-6	1.1193E+10			
S08-40-25	1.0030	48.20	84.91	3.0222	0.32117	4.03				6.8178	4.4016								1.1193E+10			
S08-41-25	1.0030	49.59	86.99	3.0221	0.32116	4.00		1.4345	4.4185	2.6272									1.1193E+10			
S08-42-25	1.0029	50.32	91.01	3.0221	0.32116	3.96				3.2664	1.7099								1.1193E+10			
S08-43-25	1.0029	50.35	93.96	3.0221	0.32116	4.03				2.5852	1.2438								1.1193E+10			
S08-44-25	1.0029	49.93	100.89	3.0221	0.32115	4.01				2.1735	0.8944								1.1193E+10			
S08-45-25	1.0029	99.80	106.00	3.0221	0.32115	3.83				1.4962	0.5453								8.96E-6	1.1193E+10		
S08-46-25	1.0029	102.75	112.81	3.0221	0.32115	3.77				1.2924	0.5389	2.1068							7.97E-6	2.87E-6	4.74E-6	1.1193E+10
S08-47-25	1.0029	101.90	120.89	3.022049	0.32114	4.09				1.0737	0.3368								6.56E-6	1.78E-6	3.26E-6	1.1193E+10

25 C data pH 6	Mass Ceramics (g)	Flow Rate (mL/day)	Run time (days)	Diameter (microns)	Surf. Area (sq. m)	pH	corrected for dilution and BLANKS IF APPLICABLE (Gd and Hf data)												#Particles			
							Ca	Ti	Ce	Gd	Hf	U	NR-Ca	NR-Ti	NR-Ce	NR-Gd	NR-Hf	NR-U				
start	1.0037		82.75	3.0229	0.3213		ppb	ppb	ppb	ppb	ppb	ppb	5.8773	8.7075	5.6032	1.76E-5	2.25E-5	6.11E-6	1.1193E+10			
S09-40-25	1.0036	49.84	84.91	3.0228	0.3213	5.75				3.8216	5.1357	2.8104							3.06E-6	1.1193E+10		
S09-41-25	1.0036	49.78	86.99	3.0228	0.3213	5.73				2.3808	3.2956	1.8663							8.93E-6	8.30E-6	1.77E-6	1.1193E+10
S09-42-25	1.0036	48.53	91.01	3.0228	0.3213	5.69				2.1320	2.7032	1.2572							6.04E-6	6.63E-6	1.30E-6	1.1193E+10
S09-43-25	1.0036	47.25	93.96	3.0228	0.3213	5.70				12.4940	14.3829								3.50E-5	3.49E-5		1.1193E+10
S09-44-25	1.0033	48.72	100.89	3.0225	0.3212	5.76				1.2593	1.2574								6.38E-6	5.51E-6		1.1193E+10
S09-45-25	1.0033	84.50	106.00	3.0225	0.3212	5.73				1.0852	0.9567								5.51E-6	4.20E-6		1.1193E+10
S09-46-25	1.0033	84.68	112.81	3.0225	0.3212	5.47				0.7891	0.6408								3.98E-6	2.79E-6		1.1193E+10
S09-47-25	1.0032	84.00	120.89	3.022432	0.3212	5.75													3.06E-6	1.1193E+10		

Mass																			
25 C data	Ceramics	Flow Rate	Run time	Diameter	Surf. Area	pH	Ca	Ti	Ce	Gd	Hf	U	NR-Ca	NR-Ti	NR-Ce	NR-Gd	NR-Hf	NR-U	#Particles
pH 8	(g)	(mL/day)	(days)	(microns)	(sq. m)														
start	1.003836	82.75	3.0240	0.3212			ppb	ppb	ppb	ppb	ppb	ppb	g/m^2/ day	1.1182E+10					
S10-40-25	1.0038	45.94	84.91	3.0240	0.3212	7.61						1.8464							1.1182E+10
S10-41-25	1.0038	45.63	86.99	3.0240	0.3212	7.60						1.7220							1.1182E+10
S10-42-25	1.0038	44.21	91.01	3.0240	0.3212	7.61						2.5920							2.51E-6 1.1182E+10
S10-43-25	1.0038	42.88	93.96	3.0240	0.3212	7.55						2.0065							1.88E-6 1.1182E+10
S10-44-25	1.0038	40.80	100.89	3.0240	0.3212	7.53						1.5691							1.39E-6 1.1182E+10
S10-45-25	1.0038	74.44	106.00	3.0240	0.3212	7.70						1.1708							1.91E-6 1.1182E+10
S10-46-25	1.0038	64.05	112.81	3.0240	0.3212	7.41						1.2593							1.76E-6 1.1182E+10
S10-47-25	1.0038	59.23	120.89	3.023962	0.3212	7.94						1.1592							1.50E-6 1.1182E+10
																			1.79E-6 1.1182E+10
25 C data	Ceramics	Flow Rate	Run time	Diameter	Surf. Area	pH	Ca	Ti	Ce	Gd	Hf	U	NR-Ca	NR-Ti	NR-Ce	NR-Gd	NR-Hf	NR-U	#Particles
pH 10	(g)	(mL/day)	(days)	(microns)	(sq. m)														
start	1.0025	82.75	3.0237	0.3209			ppb	ppb	ppb	ppb	ppb	ppb	g/m^2/ day	1.1171E+10					
S11-40-25	1.0025	48.10	84.91	3.0237	0.3209	9.89						0.0227	2.1183						1.58E-8 2.23E-6 1.1171E+10
S11-41-25	1.0025	48.55	86.99	3.0237	0.3208	9.91						0.0244	1.9720						1.72E-8 2.10E-6 1.1171E+10
S11-43-25	1.0025	48.41	93.96	3.0237	0.3208	10.05						0.4400	0.3157	0.3585	2.1632				4.67E-7 3.35E-7 3.80E-7 2.29E-6 1.1171E+10
S11-44-25	1.0024	48.44	100.89	3.0236	0.3208	10.05						1.6708	1.0587	0.7352	1.5192	2.9505			1.19E-6 3.08E-6 1.85E-6 1.07E-6 3.13E-6 1.1171E+10
S11-45-25	1.0024	96.26	106.00	3.0236	0.3208	10.23						0.3102		0.1591	1.7452				2.19E-7 3.68E-6 1.1171E+10
S11-46-25	1.0024	99.42	112.81	3.0236	0.3208	10.09						0.0100	1.5288						1.44E-8 3.33E-6 1.1171E+10
S11-47-25	1.0024	98.16	120.89	3.023564	0.3208	9.85							1.8266						3.50E-6 1.1171E+10 2.89E-6 1.1171E+10
25 C data	Ceramics	Flow Rate	Run time	Diameter	Surf. Area	pH	Ca	Ti	Ce	Gd	Hf	U	NR-Ca	NR-Ti	NR-Ce	NR-Gd	NR-Hf	NR-U	#Particles
pH 12	(g)	(mL/day)	(days)	(microns)	(sq. m)														
start	1.0016	82.75	3.0227	0.3207			ppb	ppb	ppb	ppb	ppb	ppb	g/m^2/ day	1.1171E+10					
S12-40-25	1.0016	47.71	84.91	3.0227	0.3207	12.07							1.5236						1.59E-6 1.1171E+10
S12-41-25	1.0016	48.20	86.99	3.0227	0.3207	12.03							1.4013						1.48E-6 1.1171E+10
S12-42-25	1.0016	48.46	91.01	3.0227	0.3207	12.09							1.2164						1.29E-6 1.1171E+10
S12-43-25	1.0016	48.11	93.96	3.0227	0.3207	12.10													1.1171E+10
S12-44-25	1.0016	48.42	100.89	3.0227	0.3207	12.05													1.1171E+10
S12-45-25	1.0016	96.32	106.00	3.0227	0.3207	12.05													1.1171E+10
S12-46-25	1.0016	99.56	112.81	3.0227	0.3207	12.13													1.1171E+10
S12-47-25	1.001551	98.29	120.89	3.02274	0.3207	12.16													1.46E-6 1.1171E+10

Pu Dissolution Project (U-Ce-Ca-Tl-Hf-Gd samples) pH 2-12
 Experiments Started on : 8/4/1998 10:00:00 PM
 Experiments Terminated on : 12/17/1998 7:23:00 AM

Zirconolite

Duration: 135 days

i: U-Ce-Tl-Ca C Sample: U-Ce-Tl-Ca-Cd Ceramic P139

Starting SA= 0.32 m^2/g
 ceramic density 6.2 g/cm^3 6.20E-12 g/μm^3

Element WtFrac Element

U	0.1423
Ce	0.0519
Ca	0.0692
Tl	0.2128
Hf	0.2153
Gd	0.0600
O	0.2485
	1.0000

Surface Area Calculation	
assume spherical particles	
diameter(microns) =	3.0242
num.particles/g =	1.11E+10

50 C data	Ceramics	Mass														#Particles			
		pH	Flow Rate	Run time	Diameter	Surf. Area	corrected for dilution and BLANKS IF APPLICABLE (Gd and Hf data)												
(g)	(mL/day)	(days)	(microns)	(sq. m)	pH	Ca	Tl	Ce	Gd	Hf	U	NR-Ca	NR-Tl	NR-Ce	NR-Gd	NR-Hf	NR-U	#Particles	
start	1.0060		0.00	3.0242	0.32192	1.93	ppb	ppb	ppb	ppb	ppb	2.58E-4	4.59E-4	2.47E-4	2.92E-4	1.1204E+10			
S07-2-50	1.0059	64.18	0.27	3.0241	0.32190	1.90	89	119.6	74.49	208							1.1204E+10		
S07-3-50	1.0058	55.99	1.71	3.0240	0.32188	1.88	340	70	33.1	29.11	53	8.55E-4	5.72E-5	1.11E-4	8.44E-5	6.51E-5	1.1204E+10		
S07-4-50	1.0058	54.92	2.85	3.0240	0.32187	1.89	100	64	26.2	24.81	46	2.47E-4	5.13E-5	8.62E-5	7.08E-5	5.51E-5	1.1204E+10		
S07-5-50	1.0057	52.98	3.86	3.0239	0.32188	1.89	230	71	23.4	23.19	43	5.47E-4	5.49E-5	7.44E-5	6.36E-5	4.99E-5	1.1204E+10		
S07-6-50	1.0056	52.99	5.85	3.0238	0.32184	1.90	233	74	20.5	21.60	41	5.54E-4	5.73E-5	6.51E-5	5.93E-5	4.78E-5	1.1204E+10		
S07-7-50	1.0056	53.34	6.79	3.0238	0.32183	1.83	142	74	19.7	21.54	41	3.40E-4	6.76E-5	6.28E-5	5.95E-5	5.89E-7	4.81E-5	1.1204E+10	
S07-11-50	1.0054	50.74	11.03	3.0236	0.32180	1.95	304	57	13.8	13.86	32	6.93E-4	4.22E-5	4.19E-5	3.84E-5	3.50E-5	1.1204E+10		
S07-15-50	1.0053	52.98	15.14	3.0235	0.32177	1.88	194	38	9.5	9.71	23	4.82E-4	2.96E-5	3.01E-5	2.87E-5	2.72E-5	1.1204E+10		
S07-17-50	1.0053	53.57	16.89	3.0235	0.32176	1.88	120	34	9.1	9.83	23	2.88E-4	2.68E-5	2.92E-5	2.73E-5	3.93E-7	2.73E-5	1.1204E+10	
S07-22-50	1.0052	53.51	22.22	3.0234	0.32174	1.82	220	26	6.3	7.10	17	5.28E-4	2.03E-5	2.01E-5	1.97E-5	4.05E-7	2.02E-5	1.1204E+10	
S07-24-50	1.0051	52.88	24.14	3.0233	0.32173	1.88	96	24	6.5	6.51	17	2.27E-4	1.87E-5	2.04E-5	1.78E-5	4.40E-7	1.94E-5	1.1204E+10	
S07-25-50	1.0050	55.84	28.89	3.0232	0.32172	2.09	282	15	4.7	4.84	13	7.07E-4	1.22E-5	1.59E-5	1.40E-5		1.57E-5	1.1204E+10	
S07-26-50	1.0050	52.90	35.97	3.0231	0.32170	1.85	116	16	8.0	4.41	12	2.76E-4	1.24E-5	1.90E-5	1.21E-5		1.34E-5	1.1204E+10	
S07-27-50	1.0049	52.18	41.88	3.0231	0.32168	1.85	100	15	11.5	4.31	11	2.34E-4	1.14E-5	3.61E-5	1.17E-5		1.24E-5	1.1204E+10	
	1.0189	120.89	3.0371	0.32467													1.1204E+10		
S07-48-50	1.0189	101.52	125.90	3.0371	0.32467	1.88						0.64	0.27			3.35E-6	3.89E-7	1.1204E+10	
S07-49-50	1.0189	100.39	127.84	3.0371	0.32466	1.83		1.48				0.69	0.28			2.15E-6	3.57E-6	4.04E-7	1.1204E+10
S07-50-50	1.0189	97.77	132.82	3.0370	0.32466	1.78		2.34				0.82	0.35			3.32E-6	4.12E-6	4.86E-7	1.1204E+10
S07-51-50	1.0189	98.11	134.68	3.0370	0.32466	1.71		1.69				0.80	0.49			2.40E-6	4.02E-6	6.82E-7	1.1204E+10
																5.20E-5			

50 C data	Ceramics	Mass														#Particles			
		pH	Flow Rate	Run time	Diameter	Surf. Area	pH	Ca	Tl	Ce	Gd	Hf	U	NR-Ca	NR-Tl	NR-Ce	NR-Gd	NR-Hf	NR-U
(g)	(mL/day)	(days)	(microns)	(sq. m)	pH	Ca	Tl	Ce	Gd	Hf	U	NR-Ca	NR-Tl	NR-Ce	NR-Gd	NR-Hf	NR-U	#Particles	
start	1.0050		0.00	3.0242	0.32160	3.97	ppb	ppb	ppb	ppb	ppb	ppb	ppb	g/m^2/day	g/m^2/day	g/m^2/day	g/m^2/day	g/m^2/day	1.1193E+10
S08-2-50	1.0050	65.9936	0.27	3.0242	0.32160	3.97	207	75	52.8	28	53	6.14E-4	7.27E-5	2.09E-4	9.48E-5	7.87E-5	1.1193E+10		
S08-3-50	1.0048	55.6215	1.71	3.0240	0.32155	4.00	305	3	120.1	63	121	7.62E-4	2.45E-6	4.00E-4	1.81E-4	1.47E-4	1.1193E+10		
S08-4-50	1.0047	55.7360	2.85	3.0239	0.32153	3.95	161	3	120.7	60	68	4.03E-4	2.46E-6	4.03E-4	1.74E-4	8.32E-5	1.1193E+10		
S08-5-50	1.0046	54.3796	3.86	3.0238	0.32152	3.94	206	3	83.8	46	44	5.04E-4	2.40E-6	3.06E-4	1.30E-4	5.27E-5	1.1193E+10		
S08-6-50	1.0045	53.8883	5.85	3.0237	0.32150	3.96	106	3	80.4	39	32	2.58E-4	2.38E-6	2.60E-4	1.08E-4	3.80E-5	1.1193E+10		
S08-7-50	1.0045	54.3025	6.79	3.0237	0.32150	3.78	74	2	68.3	34	26	1.79E-4	1.60E-6	2.22E-4	9.65E-5	3.04E-5	1.1193E+10		
S08-11-50	1.0044	51.4793	11.03	3.0236	0.32147	3.94	252		86.2	40	26	5.83E-4		2.66E-4	1.08E-4	2.88E-5	1.1193E+10		
S08-15-50	1.0043	52.8494	15.14	3.0235	0.32145	3.89	93		62.4	28	18	2.20E-4		1.98E-4	7.81E-5	2.06E-5	1.1193E+10		
S08-17-50	1.0043	53.2217	16.89	3.0235	0.32145	3.85	46		53.3	23	15	1.11E-4		1.70E-4	6.42E-5	1.78E-5	1.1193E+10		
S08-22-50	1.0043	0.0028	22.22	3.0235	0.32145												1.1193E+10		
S08-24-50	1.0042	53.0938	24.14	3.0234	0.32144	3.82	93		45.0	22	16	2.21E-4		1.43E-4	5.96E-5	1.91E-5	1.1193E+10		
S08-25-50	1.0042	54.9440	28.89	3.0234	0.32143	3.95	92		30.7	13	10	2.26E-4		1.01E-4	3.73E-5	1.25E-5	1.1193E+10		
S08-26-50	1.0041	50.5510	35.97	3.0233	0.32141	3.90	91		22.8	10	9	2.06E-4		6.92E-5	2.56E-5	1.01E-5	1.1193E+10		

S08-27-50	1.0041	47.6219	41.88	3.0232	0.32140	3.88	99		16.2	7	9	2.11E-4	4.63E-5	1.81E-5	9.20E-6	1.1193E+10			
	1.00292		120.89	3.02210	0.32116											1.1193E+10			
S08-48-50	1.0029	85.0834	125.90	3.0221	0.32115	3.96			1.17	0.42	1.43		5.98E-6	1.86E-6	2.67E-6	1.1193E+10			
S08-49-50	1.0029	84.1188	127.84	3.0221	0.32115	3.88			1.43	0.51	1.85		7.21E-6	2.24E-6	3.40E-6	1.1193E+10			
S08-50-50	1.0029	84.4970	132.82	3.0221	0.32115	3.92			1.82	0.73	2.11		9.23E-6	3.19E-6	3.91E-6	1.1193E+10			
S08-51-50	1.0029	82.2496	134.68	3.0221	0.32115	3.93			1.87	0.75	2.10		9.23E-6	3.19E-6	3.78E-6	1.1193E+10			
						3.91										3.30E-5			
Mass																			
50 C data	Ceramics	Flow Rate	Run time	Diameter	Surf. Area	pH										#Particles			
pH 6	(g)	(mL/day)	(days)	(microns)	(sq. m)	pH	Ca	Tl	Ce	Gd	Hf	U	NR-Ca	NR-Tl	NR-Ce	NR-Gd	NR-Hf	NR-U	
start	1.0050		0.00	3.0242	0.32160	5.77	ppb	ppb	ppb	ppb	ppb	ppb	g/m^2/ day	1.1193E+10					
S09-2-50	1.0050	65.0359	0.27	3.0242	0.32160	5.78	408		43.7	28		33	1.19E-3	1.70E-4	8.71E-5	4.72E-5	1.1193E+10		
S09-3-50	1.0049	56.8915	1.71	3.0241	0.32158	5.79	260		52.2	25		34	6.66E-4	1.78E-4	7.50E-5	4.18E-5	1.1193E+10		
S09-4-50	1.0049	55.5877	2.85	3.0241	0.32158	5.72	209		45.7	28		27	5.23E-4	1.52E-4	7.44E-5	3.23E-5	1.1193E+10		
S09-5-50	1.0049	53.8445	3.86	3.0241	0.32157	5.76	210		44.7	25		24	5.09E-4	1.44E-4	7.08E-5	2.78E-5	1.1193E+10		
S09-6-50	1.0048	53.5526	5.85	3.0240	0.32156	5.74	235		43.3	25		21	5.65E-4	1.39E-4	6.88E-5	2.49E-5	1.1193E+10		
S09-7-50	1.0048	53.3317	6.79	3.0240	0.32156	5.68	185		36.1	20		16	4.44E-4	1.18E-4	5.51E-5	1.87E-5	1.1193E+10		
S09-11-50	1.0047	50.7804	11.03	3.0238	0.32153	5.60	457		55.0	35		30	1.04E-3	1.87E-4	9.12E-5	3.34E-5	1.1193E+10		
S09-15-50	1.0046	52.2406	15.14	3.0238	0.32151	5.61	379		25.6	16		15	8.91E-4	8.01E-5	4.42E-5	1.68E-5	1.1193E+10		
S09-17-50	1.0046	52.2936	16.89	3.0237	0.32151	5.87	149		19.8	13		14	3.50E-4	6.21E-5	3.82E-5	1.63E-5	1.1193E+10		
S09-22-50	1.0045	50.8576	22.22	3.0237	0.32149	5.72	129		14.4	11		14	2.94E-4	4.38E-5	2.98E-5	1.57E-5	1.1193E+10		
S09-24-50	1.0045	0.0000	24.14	3.0237	0.32149											1.1193E+10			
S09-25-50	1.0044	51.8589	28.89	3.0236	0.32148	5.72	314		6.2	6		9	7.32E-4	1.92E-5	1.52E-5	1.00E-5	1.1193E+10		
S09-26-50	1.0044	48.1745	35.87	3.0236	0.32146	5.78	107		5.6	6		8	2.31E-4	1.61E-5	1.39E-5	9.36E-6	1.1193E+10		
S09-27-50	1.0043	47.5073	41.88	3.0235	0.32145	5.62	69		4.3	5		8	1.48E-4	1.23E-5	1.12E-5	8.12E-6	1.1193E+10		
	1.0031		120.89	3.0223	0.32120				0.40	0.32				2.03E-6	1.39E-6		1.1193E+10		
S09-48-50	1.0031	84.7928	125.90	3.0223	0.32120	5.73											1.1193E+10		
S09-49-50	1.0031	85.4675	127.84	3.0223	0.32120	5.69		1.53	0.58	0.43		1.18	1.91E-6	2.98E-6	1.91E-6	2.21E-6	1.1193E+10		
S09-50-50	1.0031	86.8393	132.82	3.0223	0.32119	5.71			0.86	0.68		1.86		4.48E-6	3.05E-6	3.53E-6	1.1193E+10		
S09-51-50	1.0031	88.2034	134.68	3.0223	0.32119	5.67			0.96	0.78		1.88		5.09E-6	3.58E-6	3.82E-6	1.1193E+10		
																1.95E-5			

Mass Ceramics																	#Particles							
50 C data	pH 8	Flow Rate (g)	Run time (mL/day)	Diameter (days)	Surf. Area (microns)	(sq. m)	pH	Ca	Tl	Ce	Gd	Hf	U	NR-Ca	NR-Tl	NR-Ce	NR-Gd	NR-Hf	NR-U					
	start	1.0040	0.00	3.0242	0.32128	7.95	ppb	ppb	ppb	ppb	ppb	ppb	ppb	g/m^2/day	g/m^2/day	g/m^2/day	g/m^2/day	g/m^2/day	1.1182E+10					
S10-2-50	1.0040	65.2740	0.27	3.0242	0.32128	7.82	66							1.95E-4					1.1182E+10					
S10-3-50	1.0040	57.3862	1.71	3.0242	0.32128	7.68	152							3.91E-4					1.1182E+10					
S10-4-50	1.0040	56.3362	2.85	3.0242	0.32128	7.72	207							5.25E-4					1.1182E+10					
S10-5-50	1.0040	54.3168	3.86	3.0242	0.32128	7.73	60							1.48E-4					1.1182E+10					
S10-6-50	1.0040	50.1255	5.85	3.0242	0.32128	7.69	102	3		1.0	2.5			2.29E-4	2.21E-6	0.00E+0	2.58E-6	1.84E-6	1.1182E+10					
S10-7-50	1.0040	53.5772	6.79	3.0242	0.32128	7.62	106	1		0.3	0.5			2.55E-4	5.52E-7	0.00E+0	8.00E-7	4.05E-7	1.1182E+10					
S10-11-50	1.0040	51.2553	11.03	3.0242	0.32128	7.59	251		0.2		0.2	3		5.78E-4	6.22E-7	0.00E+0	1.85E-7	3.19E-8	1.1182E+10					
S10-15-50	1.0040	52.9071	15.14	3.0242	0.32127	7.81	168		0.2			3		4.00E-4	6.42E-7	0.00E+0	0.00E+0	3.38E-6	1.1182E+10					
S10-17-50	1.0040	53.1787	16.89	3.0242	0.32127	7.55	178							3	4.28E-4				3.39E-6	1.1182E+10				
S10-22-50	1.0039	51.3749	22.22	3.0241	0.32127	8.01	94							3	2.16E-4				3.17E-6	1.1182E+10				
S10-25-50	1.0039	55.0119	28.89	3.0241	0.32126	7.78	191							3	2.30E-4				3.71E-6	1.1182E+10				
S10-26-50	1.0039	50.8038	35.97	3.0241	0.32126	7.54	116							3	2.63E-4				3.27E-6	1.1182E+10				
S10-27-50	1.0039	48.1758	41.88	3.0241	0.32126	7.76	73							3	1.59E-4				2.84E-6	1.1182E+10				
	1.0038		120.89	3.0240	0.32123														1.1182E+10					
S10-48-50	1.0038	73.5578	125.90	3.0240	0.32123	7.78								1.33					2.14E-6	1.1182E+10				
S10-49-50	1.0038	70.8608	127.84	3.0240	0.32123	7.87								1.12					1.73E-6	1.1182E+10				
S10-50-50	1.0038	67.7347	132.82	3.0240	0.32123	7.75								0.67					1.77E-6	1.1182E+10				
S10-51-50	1.0038	67.0243	134.68	3.0240	0.32123	7.88								1.19					1.91E-6	1.1182E+10				
														1.30										
Mass Ceramics																	#Particles							
50 C data	pH 10	Flow Rate (g)	Run time (mL/day)	Diameter (days)	Surf. Area (microns)	(sq. m)	pH	Ca	Tl	Ce	Gd	Hf	U	NR-Ca	NR-Tl	NR-Ce	NR-Gd	NR-Hf	NR-U					
	start	1.0030	0.00	3.0242	0.32096	10.13	ppb	ppb	ppb	ppb	ppb	ppb	ppb	g/m^2/day	g/m^2/day	g/m^2/day	g/m^2/day	g/m^2/day	g/m^2/day	1.1171E+10				
S11-2-50	1.0030	64.5482	0.27	3.0242	0.32096	9.76	87							4	2.51E-4				5.03E-6	1.1171E+10				
S11-3-50	1.0030	56.5102	1.71	3.0242	0.32096	9.87	84							3	2.15E-4				4.05E-6	1.1171E+10				
S11-4-50	1.0030	55.8758	2.85	3.0242	0.32096	9.90	160							3	4.02E-4				3.43E-6	1.1171E+10				
S11-5-50	1.0030	53.8216	3.86	3.0242	0.32096	9.84	56							3	1.37E-4				3.08E-6	1.1171E+10				
S11-6-50	1.0030	53.2854	5.85	3.0242	0.32096	9.94	118	0.30						2	2.83E-4	2.36E-7			2.62E-6	1.1171E+10				
S11-7-50	1.0030	53.4532	6.79	3.0242	0.32096	9.82	121	0.50						2	2.91E-4	3.94E-7			2.57E-6	1.1171E+10				
S11-11-50	1.0029	51.5525	11.03	3.0241	0.32095	9.93	949							0.2	0.3	7	2.20E-3		5.73E-7	1.87E-7	7.73E-6	1.1171E+10		
S11-15-50	1.0029	53.8638	15.14	3.0241	0.32094	10.01	175							6	4.25E-4					6.68E-6	1.1171E+10			
S11-17-50	1.0029	54.1129	16.89	3.0241	0.32094	9.73	165							5	4.02E-4					6.22E-6	1.1171E+10			
S11-22-50	1.0029	54.2108	22.22	3.0241	0.32093	9.94	535							5	1.31E-3					6.00E-6	1.1171E+10			
S11-24-50	1.0029	53.7422	24.14	3.0241	0.32093	9.88	141							5	3.41E-4					5.70E-6	1.1171E+10			
S11-25-50	1.0028	56.6617	28.89	3.0240	0.32093	10.02	101							5	2.57E-4					5.87E-6	1.1171E+10			
S11-26-50	1.0028	53.0911	35.97	3.0240	0.32092	9.78	95							5	2.28E-4					5.29E-6	1.1171E+10			
S11-27-50	1.0028	51.8071	41.88	3.0240	0.32091	9.85	40							2	9.35E-5					2.71E-6	1.1171E+10			
	1.0024		120.89	3.0236	0.32083															1.1171E+10				
S11-48-50	1.0023	98.9447	125.90	3.0235	0.32082	10.09								2.29		0.03	2.45		3.32E-6		4.83E-8	5.31E-6	1.1171E+10	
S11-49-50	1.0023	98.2152	127.84	3.0235	0.32082	10.15													2.36		0.00E+0	5.08E-6	1.1171E+10	
S11-50-50	1.0023	93.8527	132.82	3.0235	0.32081	10.23													0.01	2.45		1.09E-8	5.03E-6	1.1171E+10
S11-51-50	1.0023	98.3551	134.68	3.0235	0.32081	10.18													-0.002	2.37			5.10E-6	1.1171E+10
						9.85																4.85E-6		
Mass Ceramics																	#Particles							
50 C data	pH 12	Flow Rate (g)	Run time (mL/day)	Diameter (days)	Surf. Area (microns)	(sq. m)	pH	Ca	Tl	Ce	Gd	Hf	U	NR-Ca	NR-Tl	NR-Ce	NR-Gd	NR-Hf	NR-U					
	start	1.0030	0.00	3.0242	0.32096	12.28	ppb	ppb	ppb	ppb	ppb	ppb	ppb	g/m^2/day	g/m^2/day	g/m^2/day	g/m^2/day	g/m^2/day	g/m^2/day	1.1171E+10				
S12-2-50	1.0029	63.5809	0.27	3.0241	0.32095	12.07	990							147	2.83E-3					2.05E-4	1.1171E+10			
S12-3-50	1.0028	55.5203	1.71	3.0240	0.32091	12.09	374							93	9.35E-4					1.13E-4	1.1171E+10			
S12-4-50	1.0027	54.7422	2.85	3.0239	0.32090	12.02	298	1	60.4					51	7.34E-4	4.03E-7	1.99E-4			8.11E-5	1.1171E+10			
S12-5-50	1.0027	52.8493	3.86	3.0239	0.32089	11.99	105	0.4						41	2.49E-4	3.12E-7				4.72E-5	1.1171E+10			
S12-6-50	1.0026	52.7835	5.85	3.0238	0.32087	12.08	48	1						32	1.15E-4	4.88E-7				3.75E-5	1.1171E+10			
S12-7-50	1.0026	52.4584	6.79	3.0238	0.32087	12.11	109							27	2.57E-4					3.14E-5	1.1171E+10			

S12-11-50	1.0024	48.8690	11.03	3.0236	0.32084	11.87	194		0.2	32	4.28E-4		1.69E-7	3.42E-5	1.1171E+10
S12-15-50	1.0023	53.0899	15.14	3.0235	0.32082	11.94	143		14	3.42E-4			1.63E-5	1.1171E+10	
S12-17-50	1.0023	53.3111	16.89	3.0235	0.32082	12.09	108		13	2.59E-4			1.56E-5	1.1171E+10	
S12-22-50	1.0023	52.8482	22.22	3.0235	0.32080	12.13	120		10	2.84E-4			1.10E-5	1.1171E+10	
S12-24-50	1.0022	52.7699	24.14	3.0234	0.32080	11.96	90		10	2.13E-4			1.19E-5	1.1171E+10	
S12-25-50	1.0022	53.6168	28.89	3.0234	0.32079	12.10	58		7	1.39E-4			8.45E-6	1.1171E+10	
S12-26-50	1.0021	52.5279	35.97	3.0233	0.32077	11.98	81		8	1.91E-4			9.59E-6	1.1171E+10	
S12-27-50	1.0021	50.5687	41.88	3.0233	0.32076	11.97	27		8	8.20E-5			8.78E-6	1.1171E+10	
	1.0016		120.89	3.0227	0.32065									1.1171E+10	
S12-48-50	1.0015	99.5975	125.90	3.0227	0.32065	12.19			1.35				2.96E-6	1.1171E+10	
S12-49-50	1.0015	98.8621	127.84	3.0227	0.32065	12.17			1.54				3.33E-6	1.1171E+10	
S12-50-50	1.0015	98.0341	132.82	3.0227	0.32065	12.26			1.67				3.60E-6	1.1171E+10	
S12-51-50	1.0015	99.3084	134.68	3.0227	0.32065	12.16			1.51				3.28E-6	1.1171E+10	

Pu Dissolution Project (U-Ce-Ca-Ti-Hf-Gd samples) pH 2-12 Zirconolite
 Experiments Started on : 8/4/1998 10:00:00 PM
 Experiments terminated on : 12/21/2000 3:50:00 PM Duration: 870 days

Sample: U-Ce-Ti-Ca-Gd Ceramic P139 Sample: U-Ce-Ti-Ca Ceramic

Starting SA= 0.32 m^2/g
 ceramic density 6.2 g/cm^3 6.2E-12 g/μm^3

Element	#Frac Element
U	0.1423
Ce	0.0519
Ca	0.0692
Ti	0.2128
Hf	0.2153
Gd	0.0600

Surface Area Calculation
 assume spherical particles
 diameter(microns) = 3.02
 num.particles/g = 1.114E+10

0.7515

#Particles is calculated at beginning of exp then stays the same

75 C data pH 2	Mass Ceramics (g)	Flow Rate (mL/day)	Run time (days)	Diameter (microns)	Surf. Area (sq. m)	75 C da corrected for dilution and BLANKS IF APPLICABLE (Gd and Hf data)												#Particles		
						pH	pH 2	Ca	Ti	Ce	Gd	Hf	U	NR-Ca	NR-Ti	NR-Ce	NR-Gd	NR-Hf	NR-U	
start	1.0049		41.88	3.0231	0.32156	2.16	start	ppb	ppb	ppb	ppb	ppb	ppb	g/m^2/day	g/m^2/day	g/m^2/day	g/m^2/day	g/m^2/day	1.1204E+10	
S07-28-75	1.0044	31.3775	47.84	3.0226	0.32158	2.07	17-28-	334	48	52	49	0.88	110.49	4.71E-4	2.21E-5	9.87E-5	7.93E-5	3.08E-7	7.58E-5	1.1204E+10
S07-29-75	1.0044	37.7499	48.82	3.0226	0.32157	1.85	17-29-	299	54	36	32	0.39	76.12	5.07E-4	2.98E-5	8.14E-5	6.21E-5	2.14E-7	6.28E-5	1.1204E+10
S07-30-75	1.0043	36.7645	49.83	3.0225	0.32156	1.91	17-30-	162	53	29	27	0.38	64.67	2.68E-4	2.85E-5	6.38E-5	5.14E-5	2.01E-7	5.20E-5	1.1204E+10
S07-31-75	1.0043	35.7066	50.80	3.0225	0.32155	1.98	17-31-	152	51	25	23	0.35	56.71	2.44E-4	2.66E-5	5.31E-5	4.25E-5	1.79E-7	4.43E-5	1.1204E+10
S07-32-75	1.0041	39.6139	54.93	3.0223	0.32152	1.88	17-32-	194	39	17	14		36.64	3.45E-4	2.26E-5	3.93E-5	2.95E-5	3.17E-5	1.1204E+10	
S07-33-75	1.0040	38.1306	58.96	3.0222	0.32150	1.77	17-33-	105	36	14	11		31.96	1.80E-4	2.01E-5	3.16E-5	2.21E-5	2.86E-5	1.1204E+10	
S07-34-75	1.0039	37.6386	62.90	3.0221	0.32148	1.81	17-34-	182	37	12	11		29.97	3.08E-4	2.04E-5	2.79E-5	2.21E-5	2.47E-5	1.1204E+10	
S07-35-75	1.0039	36.4207	66.02	3.0220	0.32146	1.90	17-35-	349	34	13	12		31.09	5.71E-4	1.81E-5	2.80E-5	2.23E-5	2.48E-5	1.1204E+10	
S07-36-75	1.0038	68.1701	69.87	3.0220	0.32145	1.86	17-36-75		21	6	6	0.25	14.35	2.08E-5	2.52E-5	2.07E-5	2.51E-7	2.14E-5	1.1204E+10	
S07-37-75	1.0037	79.0197	72.88	3.0219	0.32143	1.80	17-37-75		17	6	6		13.05	1.95E-5	2.61E-5	2.27E-5	2.25E-5	1.1204E+10		
S07-38-75	1.0036	80.0235	77.88	3.0218	0.32141	1.72	17-38-75		16	7	5		12.53	1.92E-5	3.25E-5	2.25E-5	2.19E-5	1.1204E+10		
S07-39-75	1.0035	82.7189	82.75	3.0217	0.32139	1.87	17-39-75		14	5	4	0.29	10.11	1.67E-5	2.53E-5	1.93E-5	3.45E-7	1.83E-5	1.1204E+10	
	1.0189		134.68	3.0370																
S07-52-75	1.0020	61.5610	282.84	3.0202	0.32106	1.94	17-52-75			3	2	0.50	5.71		1.23E-5	7.05E-6	4.41E-7	7.88E-6	1.1204E+10	
S07-53-75	1.0017	54.6096	337.94	3.0198	0.32099	2.11	17-53-75			2	2		4.66		7.21E-6	4.44E-6	5.57E-6	1.1204E+10		
S07-55-75	1.0015	52.3190	377.89	3.0197	0.32095	1.97	17-55-75			1			4.15		3.04E-6	4.76E-6	1.1204E+10			
S07-57-75	1.0013	53.6054	426.81	3.0195	0.32092	1.74	17-57-75		3.1	1.2	0.5		2.79		3.79E-6	1.41E-6	3.28E-6	1.1204E+10		
S07-58-75	1.0012	55.7879	468.91	3.0194	0.32089	1.85	17-58-75		3.0	1.2	0.5		2.58		3.98E-6	1.45E-6	3.15E-6	1.1204E+10		
S07-59-75	1.0010	57.8331	553.85	3.0192	0.32085	1.94	17-59-75		3.5	0.8	0.6	0.00	1.63		2.90E-6	1.84E-6	2.05E-6	1.1204E+10		
S07-60-75	1.0009	54.2002	636.89	3.0191	0.32083	1.90	17-60-75		2.7	0.7	0.9	0.00	1.21		2.19E-6	2.62E-6	1.44E-6	1.1204E+10		
S07-61-75	1.0008	58.8883	655.81	3.0190	0.32082	1.70	17-61-75		3.2	1.2	0.8	1.50	2.03		4.14E-6	2.40E-6	1.28E-6	2.62E-6	1.1204E+10	
S07-62-75	1.0004	76.1213	807.13	3.0185	0.32072	1.94	17-62-75		5.4	0.9	0.6	2.21	1.83		4.15E-6	2.53E-6	2.43E-6	3.05E-6	1.1204E+10	
S07-64-75	1.0003	244.5297	827.91	3.0184	0.32070	1.74	17-64-75		1.3	1.0	0.4	2.48	1.01		1.40E-5	5.52E-6	8.77E-6	5.44E-6	1.1204E+10	
S07-64-75	1.0002	234.1797	832.84	3.0184	0.32069	2.12	17-64-75		2.0	0.6	0.4	1.58	1.43		8.08E-6	5.30E-6	5.36E-6	7.36E-6	1.1204E+10	
	0.42			3.0221	Angstroms	21.1									average	2.06E-5				

75 C data pH 4	Mass Ceramics (g)	Flow Rate (mL/day)	Run time (days)	Diameter (microns)	Surf. Area (sq. m)	75 C data												#Particles	
						pH	pH 4	Ca	Ti	Ce	Gd	Hf	U	NR-Ca	NR-Ti	NR-Ce	NR-Gd	NR-Hf	NR-U
Start	1.0041		41.88	3.0232	0.32130	3.85	start	ppb	ppb	ppb	ppb	ppb	ppb	g/m^2/day	g/m^2/day	g/m^2/day	g/m^2/day	g/m^2/day	1.1193E+10
S08-28-75	1.0039	39.0046	47.84	3.0231	0.32136	3.98	18-28-	131	8	6	33.57	2.28E-4	1.88E-5	1.12E-5	2.86E-5	1.1193E+10			
S08-29-75	1.0038	42.2345	48.82	3.0230	0.32135	3.99	18-29-	181	12	12	56.76	3.44E-4	3.16E-5	2.55E-5	5.24E-5	1.1193E+10			
S08-30-75	1.0038	42.1894	49.83	3.0230	0.32134	3.93	18-30-	114	12	12	46.01	2.16E-4	3.02E-5	2.67E-5	4.25E-5	1.1193E+10			
S08-31-75	1.0038	43.9763	50.80	3.0229	0.32133	4.00	18-31-	253	12	13	40.06	5.00E-4	3.09E-5	2.87E-5	3.85E-5	1.1193E+10			
S08-32-75	1.0038	41.9007	54.93	3.0228	0.32131	3.99	18-32-	213	15	14	30.38	4.01E-4	3.85E-5	3.07E-5	2.78E-5	1.1193E+10			
S08-33-75	1.0035	41.2278	58.98	3.0227	0.32129	3.97	18-33-	412	12	11	27.11	7.64E-4	2.89E-5	2.38E-5	2.44E-5	1.1193E+10			
S08-34-75	1.0034	40.9506	62.90	3.0226	0.32126	3.95	18-34-	341	12	11	40.40	6.28E-4	3.01E-5	2.39E-5	6.17E-7	3.62E-5	1.1193E+10		

S08-35-75	1.0033	39.2055	66.02	3.0225	0.32124	3.97	18-35-	114		10	9	23.84	2.01E-4	2.41E-5	1.89E-5	2.03E-5	1.1193E+10		
S08-38-75	1.0032	77.1857	69.87	3.0224	0.32122	3.99	18-36-75		1.53	7	6	14.98	1.73E-6	3.42E-5	2.53E-5	2.53E-5	1.1193E+10		
S08-37-75	1.0032	84.0389	72.86	3.0224	0.32121	4.05	18-37-75			5	4	10.50		2.81E-5	1.85E-5	1.93E-5	1.1193E+10		
S08-38-75	1.0031	93.7822	77.88	3.0223	0.32119	3.90	18-38-75		1.40	6	5	9.84	1.92E-6	3.20E-5	2.38E-5	2.02E-5	1.1193E+10		
S08-39-75	1.0030	87.2998	82.75	3.0222	0.32117	3.85	18-39-75			5	4	8.95		2.57E-5	1.68E-5	1.71E-5	1.1193E+10		
	1.0029		134.6819	3.0221															
S08-52-75	1.0014	66.0282	282.84	3.0206	0.32084	3.87	18-52-75			1	4	5.40		3.93E-6	1.40E-5	7.81E-6	1.1193E+10		
S08-53-75	1.0011	51.5979	337.94	3.0203	0.32078	4.19	18-53-75			3		4.57			7.35E-6	5.17E-6	1.1193E+10		
S08-55-75	1.0009	50.1744	377.89	3.0201	0.32073	3.96	18-55-75			1	3	4.72		3.15E-6	8.28E-6	5.19E-6	1.1193E+10		
S08-57-75	1.0007	53.8998	426.81	3.0199	0.32069	3.87	18-57-75			0.9	0.9	3.50		2.98E-6	2.61E-6	4.13E-6	1.1193E+10		
S08-58-75	1.0005	52.6898	468.91	3.0197	0.32065	3.85	18-58-75			1.1	1.3	4.13		3.49E-6	3.44E-6	4.77E-6	1.1193E+10		
S08-59-75	1.0004	53.0746	553.85	3.0195	0.32061	4.10	18-59-75			1	1	1.86		2.62E-6	2.66E-6	2.17E-6	1.1193E+10		
S08-60-75	1.0002	44.8497	636.89	3.0194	0.32058	4.16	18-60-75			1	1	1.68		1.88E-6	2.04E-6	1.65E-6	1.1193E+10		
S08-61-75	1.0002	50.0192	655.81	3.0194	0.32057	3.89	18-61-75		0.22	1	1	0.06	1.61	1.63E-7	2.91E-6	1.84E-6	4.05E-8	1.76E-6	1.1193E+10
S08-62-75	0.8998	58.2153	807.13	3.0189	0.32048	3.98	18-62-75		0.39	1	1	0.06	2.11	3.35E-7	4.94E-6	2.87E-6	4.67E-6	2.70E-6	1.1193E+10
S08-64-75	0.9997	125.5277	827.91	3.0189	0.32047	3.72	18-64-75		0.25	1	1	0.06	1.58	4.58E-7	8.08E-6	3.84E-6	9.92E-6	4.24E-6	1.1193E+10
S08-65-75	0.9996	94.5129	834.91	3.0187	0.32044	4.00	18-65-75		0.58	3	2	0.06	7.80	8.10E-7	1.61E-5	9.24E-6	8.00E-6	1.62E-5	1.1193E+10
S08-66-75	0.9995	96.3381	867.87	3.0186	0.32042	3.94	18-66-75		0.59	2	1	0.07	1.71	8.38E-7	9.23E-6	3.68E-6	1.01E-7	3.60E-6	1.1193E+10
% loss	0.46			23.1	Angstroms									average	1.72E-5				

75 C data pH 6	Mass Ceramics	Flow Rate (mL/day)	Run time (days)	Diameter (microns)	Surf. Area (sq. m)	75 C data		Ca	Tl	Ce	Gd	Hf	U	NR-Ca	NR-Tl	NR-Ce	NR-Gd	NR-Hf	NR-U	#Particles	
						pH	pH 6														
start	1.0043		41.8771	3.0235	0.3214	5.60	start	ppb	ppb	ppb	ppb	ppb	ppb	ppb	g/m^2/ day	1.1193E+10					
S09-28-75	1.0043	32.9830	47.84	3.0235	0.3214	5.73	19-28-	107		0.38	1.39	11.94	1.58E-4	7.58E-7	2.38E-6	8.61E-6	1.1193E+10				
S09-29-75	1.0042	39.8001	48.82	3.0234	0.3214	5.60	19-29-	175		0.31	2.51	17.88	3.11E-4	7.41E-7	5.16E-6	1.53E-5	1.1193E+10				
S09-30-75	1.0042	25.3118	49.83	3.0234	0.3214	5.89	19-30-	493			1.48	20.47	5.61E-4	1.94E-6	1.94E-6	1.13E-5	1.1193E+10				
S09-31-75	1.0042	40.5125	50.80	3.0234	0.3214	5.63	19-31-	298			1.74	21.50	5.43E-4	3.85E-6	3.85E-6	1.90E-5	1.1193E+10				
S09-32-75	1.0041	45.7257	54.93	3.0233	0.3214	5.76	19-32-	138.85			1.94	18.14	2.85E-4	4.60E-6	4.60E-6	1.81E-5	1.1193E+10				
S09-33-75	1.0041	47.2398	58.96	3.0233	0.3214	5.75	19-33-	109			1.85	15.19	2.31E-4	4.54E-6	4.54E-6	1.57E-5	1.1193E+10				
S09-34-75	1.0040	47.1130	62.90	3.0232	0.3214	5.78	19-34-	163			1.79	14.06	3.45E-4	4.38E-6	4.38E-6	1.45E-5	1.1193E+10				
S09-35-75	1.0040	46.7285	66.02	3.0232	0.3214	5.65	19-35-	1726			1.68	12.54	3.63E-3	4.08E-6	4.08E-6	1.28E-5	1.1193E+10				
S09-36-75	1.0039	85.9074	69.87	3.0231	0.3214	5.85	19-36-75		1.07		1.55	10.81		5.51E-6	6.92E-6	2.03E-5	1.1193E+10				
S09-37-75	1.0039	93.8597	72.86	3.0230	0.3214	5.63	19-37-75			0.79	1.11	8.13		4.42E-6	5.38E-6	1.67E-5	1.1193E+10				
S09-38-75	1.0038	101.9380	77.88	3.0230	0.3213	5.61	19-38-75			0.83	1.19	7.30		5.05E-6	6.31E-6	1.63E-5	1.1193E+10				
S09-39-75	1.0037	92.6650	82.75	3.0229	0.3213	5.58	19-39-75			0.96	1.39	7.63		5.35E-6	6.70E-6	1.55E-5	1.1193E+10				
	1.0031		134.68	3.0223																	
S09-52-75	1.0031	60.3219	282.84	3.0223	0.3212	6.39	19-52-75													1.1193E+10	
S09-53-75	1.0031	52.4091	337.94	3.0223	0.3212	6.24	19-53-75													1.1193E+10	
S09-55-75	1.0031	50.3480	377.89	3.0223	0.3212	6.07	19-55-75													1.1193E+10	
S09-57-75	1.0030	35.5653	426.81	3.0222	0.3212	5.82	19-57-75					3.20								2.49E-6	1.1193E+10
S09-58-75	1.0029	20.4170	468.91	3.0221	0.3212	6.00	19-58-75					3.10								1.38E-6	1.1193E+10
S09-60-75	1.0028	10.4485	636.89	3.0220	0.3211	6.23	19-60-75		0.64		0.27	3.83	9.79E-8	1.49E-7	0.00E+0	8.30E-7	1.1193E+10				
S09-61-75	1.0027	27.4018	655.81	3.0219	0.3211	6.11	19-61-75		0.07	0.10	0.32	0.05	3.45	2.84E-8	1.72E-7	4.62E-7	1.99E-8	2.07E-6	1.1193E+10		
S09-62-75	1.0021	63.1534	807.12	3.0213	0.3210	6.25	19-62-75		0.24	0.13	0.43	0.06	2.91	2.20E-7	4.98E-7	1.42E-6	5.52E-8	4.02E-6	1.1193E+10		
S09-65-75	1.0020	208.7648	834.91	3.0212	0.3210	6.19	19-65-75		0.08	0.08	0.25	0.05	0.98	2.30E-7	1.06E-6	2.67E-6	1.43E-7	4.39E-6	1.1193E+10		
% loss	0.23			11.6	Angstroms										average	1.11E-5					

75 C data pH 8	Mass Ceramics																		#Particles			
	Ceramics (g)	Flow Rate (mL/day)	Run time (days)	Diameter (microns)	Surf. Area (sq. m)	75 C data				Ca	Tl	Ce	Gd	Hf	U	NR-Ca	NR-Tl	NR-Ce	NR-Gd	NR-Hf	NR-U	
start	1.0039	39.8876	41.88	3.0241	0.3212	7.45	start	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb/m^2/day	ppb/m^2/day	ppb/m^2/day	ppb/m^2/day	ppb/m^2/day	ppb/m^2/day	1.1182E+10	
S10-28-75	1.0039	41.6143	47.84	3.0241	0.3213	7.69	10-28-	41		0.3		0.6	2.56	7.37E-5	7.56E-7	3.64E-7	2.22E-6	1.1182E+10				
S10-29-75	1.0039	41.6143	48.82	3.0241	0.3213	7.67	10-29-	71		0.4		2.04	1.32E-4		9.36E-7				1.86E-6	1.1182E+10		
S10-30-75	1.0039	40.1422	49.83	3.0241	0.3213	7.59	10-30-	106				2.25	1.91E-4						1.98E-6	1.1182E+10		
S10-31-75	1.0039	40.3930	50.80	3.0241	0.3213	7.67	10-31-	103					0.3	2.40	2.07E-4					1.1182E+10		
S10-32-75	1.0039	41.4422	54.93	3.0241	0.3213	7.60	10-32-	73				0.4	0.2	1.1	2.83	1.91E-4	8.88E-7	5.38E-7	6.80E-7	2.61E-6	1.1182E+10	
S10-33-75	1.0039	43.9429	58.96	3.0241	0.3213	7.66	10-33-	105				0.5	2.13	4.19E-5					2.80E-7	1.98E-6	1.1182E+10	
S10-34-75	1.0038	42.2001	62.90	3.0240	0.3212	7.73	10-35-	22						1.20							2.02E-6	1.1182E+10
S10-35-75	1.0038	42.0216	66.02	3.0240	0.3212	7.73	10-35-	22														
S10-36-75	1.0038	77.2146	69.87	3.0240	0.3212	7.89	10-36-75															
S10-37-75	1.0038	83.6247	72.86	3.0240	0.3212	7.73	10-37-75															
S10-38-75	1.0038	89.6369	77.88	3.0240	0.3212	7.63	10-38-75															
S10-39-75	1.0038	84.0047	82.75	3.02403	0.3212	7.74	10-39-75															
	1.0038		134.68	3.0240																		
S10-52-75	1.0038	54.8113	282.84	3.02403	0.3212	7.64	10-52-75															
S10-53-75	1.0038	41.0249	337.94	3.02403	0.3212	7.59	10-53-75															
S10-55-75	1.0038	41.5987	377.89	3.02403	0.3212	7.70	10-55-75															
S10-57-75	1.0038	38.5532	426.81	3.02396	0.3212	7.86	10-57-75							1.74								
S10-58-75	1.0037	42.3478	468.91	3.02389	0.3212	7.82	10-58-75							1.81								
S10-59-75	1.0034	41.0129	553.85	3.02383	0.3212	7.60	10-59-75							3.29								
S10-60-75	1.0032	35.7702	636.89	3.02341	0.3211	7.88	10-60-75							0.04	0.08	3.45			7.87E-8	3.90E-8	2.70E-6	1.1182E+10
S10-61-75	1.0032	41.7986	655.81	3.02338	0.3211	7.71	10-61-75		0.23	0.03	0.04	0.05	1.78		1.39E-7	8.57E-8	7.63E-8	3.07E-8	1.63E-6	1.1182E+10		
S10-62-75	1.0029	57.0558	807.13	3.02313	0.3211	7.83	10-62-75		0.38	0.01	0.02	0.04	1.30		3.14E-7	2.43E-8	5.70E-8	3.64E-8	1.62E-6	1.1182E+10		
S10-63-75	1.0029	193.9037	827.91	3.02309	0.3210	7.50	10-63-75		0.24	0.01	0.01	0.05	0.42		6.82E-7	7.62E-8	7.61E-8	1.27E-7	1.78E-6	1.1182E+10		
S10-64-75	1.0029	180.2005	832.84	3.02309	0.3210	7.45	10-64-75		0.25		0.01	0.05	0.38		6.49E-7	0.00E+0	1.18E-7	1.20E-7	1.51E-6	1.1182E+10		
% loss	0.10		5.0	Angstroms														average	2.02E-6			
75 C data pH 10	Mass Ceramics																		#Particles			
	Ceramics (g)	Flow Rate (mL/day)	Run time (days)	Diameter (microns)	Surf. Area (sq. m)	75 C data				Ca	Tl	Ce	Gd	Hf	U	NR-Ca	NR-Tl	NR-Ce		NR-Gd	NR-Hf	NR-U
start	1.0028	41.88	3.0240	0.3209	9.81	start	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb/m^2/day	ppb/m^2/day	ppb/m^2/day	ppb/m^2/day	ppb/m^2/day	ppb/m^2/day	1.1171E+10	
S11-28-75	1.0028	42.3430	47.84	3.0239	0.3209	9.77	11-28-	45		0.26	0.50	5.36	8.63E-5	5.77E-7	3.08E-7	4.97E-6	1.1171E+10					
S11-29-75	1.0028	43.6761	48.82	3.0239	0.3209	9.86	11-29-	110		0.28	0.52	4.33	2.16E-4		6.41E-7	3.31E-7	4.14E-6	1.1171E+10				
S11-30-75	1.0027	43.6893	49.83	3.0239	0.3209	9.76	11-30-	106			0.27	4.69	2.08E-4						1.68E-7	4.49E-6	1.1171E+10	
S11-31-75	1.0027	44.8100	50.80	3.0239	0.3209	9.96	11-31-	40		0.25	5.97	8.14E-5						1.84E-7	5.85E-6	1.1171E+10		
S11-32-75	1.0027	43.8052	54.93	3.0239	0.3209	9.93	11-32-	61		0.21	10.90	1.20E-4						1.30E-7	1.04E-5	1.1171E+10		
S11-33-75	1.0027	41.8904	58.96	3.0239	0.3209	9.91	11-33-	80			7.59	1.50E-4						0.00E+0	6.95E-6	1.1171E+10		
S11-34-75	1.0026	44.2439	62.90	3.0238	0.3209	9.92	11-34-	183		0.21	7.55	3.65E-4						1.31E-7	7.31E-6	1.1171E+10		
S11-35-75	1.0026	43.2719	66.02	3.0238	0.3209	9.99	11-35-	117			6.65	2.28E-4						0.00E+0	6.31E-6	1.1171E+10		
S11-36-75	1.0026	81.1788	69.87	3.0238	0.3209	9.80	11-36-75			0.34	5.47							4.04E-7	9.72E-6	1.1171E+10		
S11-37-75	1.0026	91.4101	72.86	3.0237	0.3209	9.96	11-37-75			0.38	4.91							5.05E-7	9.83E-6	1.1171E+10		
S11-38-75	1.0025	98.2295	77.88	3.0237	0.3209	9.70	11-38-75			0.37	1.66							5.28E-7	3.57E-6	1.1171E+10		
S11-39-75	1.0025	91.3028	82.75	3.02368	0.3209	10.05	11-39-75		0.32	0.35	4.65						1.75E-6	4.56E-7	9.30E-6	1.1171E+10		
	1.0023	134.6819	3.0235	0.3208																	1.1171E+10	
S11-52-75	1.0023	65.8886	282.84	3.02349	0.3208	9.84	11-52-75		0.39		0.44					1.54E-6		4.24E-7			1.1171E+10	
S11-53-75	1.0022	52.9447	337.94	3.02338	0.3208	9.85	11-53-75				1.78							2.06E-6	1.1171E+10			
S11-55-75	1.0021	52.3589	377.89	3.02330	0.3208	9.88	11-55-75			0.29	1.64							2.23E-7	1.88E-6	1.1171E+10		
S11-57-75	1.0020	56.9170	426.81	3.02314	0.3207	9.82	11-57-75				2.60							3.24E-6	1.1171E+10			
S11-58-75	1.0018	55.8708	468.91	3.02301	0.3207	9.90	11-58-75				2.57							3.15E-6	1.1171E+10			
S11-59-75	1.0015	51.3075	553.85	3.02286	0.3206	9.98	11-59-75				3.69							4.15E-6	1.1171E+10			
S11-60-75	1.0011	49.1544	636.89	3.02225	0.3205	9.84	11-60-75				4.50							4.84E-6	1.1171E+10			
S11-61-75	1.0010	46.7960	655.81	3.02221	0.3205	9.55	11-61-75		0.19	0.05	0.02	0.06	2.00		1.30E-7	1.30E-7	5.74E-8	4.19E-8	2.05E-6	1.1171E+10		
S11-62-75	1.0008	61.2992	807.13	3.02199	0.3205	9.68	11-62-75		0.48	0.40	0.13	0.08	1.09		4.32E-7	1.47E-6	4.03E-7	7.32E-8	1.47E-6	1.1171E+10		
S11-63-75	1.0007	226.7707	827.91	3.02189	0.3205	9.31	11-63-75		1.56	0.09	0.02	0.06	0.99		5.19E-6	1.23E-6	2.38E-7	2.00E-7	4.91E-6	1.1171E+10		
S11-64-75	1.0007	216.9096	832.84	3.02186	0.3205	9.38	11-64-75		0.25	0.02	0.01	0.05	0.88		7.93E-7	2.96E-7	1.36E-7	1.57E-7	4.21E-6	1.1171E+10		

% loss	0.21		10.6	Angstroms														average	5.22E-6						
75 C data	Mass Ceramics	Flow Rate	Run time	Diameter	Surf. Area	75 C data																			
pH 12	(g)	(mL/day)	(days)	(microns)	(sq. m)	pH	pH 12	Ca	Tl	Ce	Gd	Hf	U	NR-Ca	NR-Tl	NR-Ce	NR-Gd	NR-Hf	NR-U	#Particles					
start	1.002080		41.88	3.023268	0.3207	11.82	start	ppb	ppb	ppb	ppb	ppb	ppb	g/m^2/ day	1.1171E+10										
S12-28-75	1.0020	18.3014	47.84	3.0232	0.3208	11.87	I2-28-	24					18.07	1.99E-5						7.25E-6	1.1171E+10				
S12-29-75	1.0020	21.9251	48.82	3.0232	0.3208	12.01	I2-29-	24					28.18	2.39E-5						1.35E-6	1.1171E+10				
S12-30-75	1.0020	16.9949	49.83	3.0232	0.3207	12.06	I2-30-	25					28.72	1.93E-5						1.07E-5	1.1171E+10				
S12-31-75	1.0020	22.5189	50.80	3.0232	0.3207	12.07	I2-31-	26					28.46	2.67E-5						1.40E-5	1.1171E+10				
S12-32-75	1.0019	32.2339	54.93	3.0231	0.3207	12.02	I2-32-	33					24.04	4.83E-5						1.70E-5	1.1171E+10				
S12-33-75	1.0019	30.3777	58.96	3.0231	0.3207	12.04	I2-33-	54					20.55	7.46E-5						1.37E-5	1.1171E+10				
S12-34-75	1.0018	21.9226	62.90	3.0230	0.3207	12.17	I2-34-	37					17.52	3.69E-5						8.42E-6	1.1171E+10				
S12-35-75	1.0018	43.2719	66.02	3.0230	0.3207	12.16	I2-35-	192					18.44	3.75E-4						1.75E-5	1.1171E+10				
S12-36-75	1.0017	54.3593	69.87	3.0229	0.3207	12.12	I2-36-75						14.01							1.67E-5	1.1171E+10				
S12-37-75	1.0017	62.5178	72.86	3.0229	0.3207	12.14	I2-37-75						9.48							1.30E-5	1.1171E+10				
S12-38-75	1.0016	96.8056	77.88	3.0228	0.3207	11.94	I2-38-75						7.06							1.50E-5	1.1171E+10				
S12-39-75	1.0016	91.4968	82.75	3.0227	0.3207	12.20	I2-39-75						5.76							1.16E-5	1.1171E+10				
	1.0015		134.68	3.0227	0.3206															1.1171E+10					
S12-52-75	1.0016	0.2718	282.84	3.0227	0.3207		S12-52-75													1.1171E+10					
S12-53-75	1.0011	45.3274	337.94	3.0223	0.3206	12.02	I2-53-75						7.60							7.55E-6	1.1171E+10				
S12-55-75	1.0010	35.2280	377.89	3.0222	0.3205	12.07	I2-55-75						4.53							3.50E-6	1.1171E+10				
S12-57-75	1.0009	34.4005	426.81	3.0221	0.3205	12.18	I2-57-75						2.82							2.13E-6	1.1171E+10				
S12-58-75	1.0008	28.4085	468.91	3.0220	0.3205	12.26	I2-58-75						3.40							2.12E-6	1.1171E+10				
S12-59-75	1.0006	25.8088	553.85	3.0218	0.3204	12.04	I2-59-75			0.06	0.06	0.13	4.80							8.78E-8	7.60E-8	4.77E-8	2.72E-6	1.1171E+10	
S12-60-75	1.0004	2.7824	657.95	3.0216	0.3204		S12-60-75		11.72	2.87	3.03	10.13	25.95							4.78E-7	4.80E-7	4.39E-7	4.09E-7	1.58E-6	1.1171E+10
S12-61-75	0.9997	69.7799	722.87	3.0209	0.3203	12.29	I2-61-75		0.25	0.12	0.11	0.15	6.63							2.80E-7	5.01E-7	3.97E-7	1.53E-7	1.01E-5	1.1171E+10
S12-62-75	0.9989	80.5992	807.13	3.0201	0.3201	10.85	I2-62-75		0.69	0.12	0.12	0.12	5.78							8.22E-7	6.05E-7	5.23E-7	1.41E-7	1.02E-5	1.1171E+10
S12-66-75	0.9985	831.2244	869.73	3.0196	0.3200	11.37	I2-66-75		0.37	0.01	0.11	0.36								4.49E-6	5.34E-7		4.38E-6	6.57E-6	1.1171E+10
% loss	0.36			18.1	Angstroms															average	9.75E-6				
data -all T's	Mass Ceramics	Flow Rate	Run time	Diameter	Surf. Area	pH	pH 12	Ca	Tl	Ce	Gd	Hf	U	NR-Ca	NR-Tl	NR-Ce	NR-Gd	NR-Hf	NR-U	#Particles					
pH 12	(g)	(mL/day)	(days)	(microns)	(sq. m)	pH	pH 12	Ca	Tl	Ce	Gd	Hf	U	NR-Ca	NR-Tl	NR-Ce	NR-Gd	NR-Hf	NR-U	#Particles					
start	1.003		0.00	3.0242	0.3210		start	ppb	ppb	ppb	ppb	ppb	ppb	g/m^2/ day	1.1171E+10										
S12A-1-75	1.0030	46.3254	0.44	3.0242	0.3210	12.03	I2A-1-75						48.17	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	4.89E-5	1.1171E+10					
S12A-2-75	1.0030	45.6188	2.06	3.0242	0.3210	12.10	I2A-2-75		0.94	1.12	0.78		62.11		6.29E-7	3.06E-6	1.84E-6	6.20E-5	1.1171E+10						
S12A-3-75	1.0030	40.0768	4.03	3.0242	0.3210	12.03	I2A-3-75						38.71						3.40E-5	1.1171E+10					
S12A-4-25	1.0030	74.9241	5.03	3.0242	0.3210	12.20	I2A-4-25						8.89						1.46E-5	1.1171E+10					
S12A-5-25	1.0030	70.1339	11.18	3.0242	0.3210	12.23	I2A-5-25						1.23						1.88E-6	1.1171E+10					
S12A-6-25	1.0030	53.3793	13.16	3.0242	0.3210	12.20	I2A-6-25						2.50						2.92E-6	1.1171E+10					
S12A-7-25	1.0030	76.4829	17.99	3.0242	0.3210	12.25	I2A-7-25						1.85						3.09E-6	1.1171E+10					
S12A-8-25	1.0030	95.4903	19.04	3.0242	0.3210	12.17	I2A-8-25						1.09						2.29E-6	1.1171E+10					
S12A-9-25	1.0030	97.4437	20.01	3.0242	0.3210	12.20	I2A-9-25						0.84						1.79E-6	1.1171E+10					
S12A-10-25	1.0030	96.2758	23.96	3.0242	0.3210	12.22	I2A-10-25						0.82						1.73E-6	1.1171E+10					
S12A-11-25	1.0030	95.8816	26.01	3.0242	0.3210	12.20	I2A-11-25						0.68						1.43E-6	1.1171E+10					
S12A-12-50	1.0030	47.8153	38.12	3.0242	0.3210	12.05	I2A-12-50						6.34						6.63E-6	1.1171E+10					
S12A-13-50	1.0030	42.0897	39.09	3.0242	0.3210	12.14	I2A-13-50						8.12						7.48E-6	1.1171E+10					
S12A-14-50	1.0030	0.0000	40.16	3.0242	0.3210		S12A-14-50												0.00E+0	1.1171E+10					
S12A-15-50	1.0030	56.9587	41.11	3.0242	0.3210	12.07	I2A-15-50						75.89						9.46E-5	1.1171E+10					
S12A-16-50	1.0030	52.2469	46.03	3.0242	0.3210	12.12	I2A-16-50						5.93						6.78E-6	1.1171E+10					
S12A-17-50	1.0030	50.9622	48.12	3.0242	0.3210	12.00	I2A-17-50						5.13						5.72E-6	1.1171E+10					
S12A-18-50	1.0030	90.5978	51.98	3.0242	0.3210	11.98	I2A-18-50						3.10						6.14E-6	1.1171E+10					
S12A-19-50	1.0030	93.8329	52.97	3.0242	0.3210	12.09	I2A-19-50						2.37						4.86E-6	1.1171E+10					
S12A-20-50	1.0030	93.3740	55.27	3.0242	0.3210	11.96	I2A-20-50						2.72						5.55E-6	1.1171E+10					
S12A-21-50	1.0030	87.7429	58.99	3.0242	0.3210	12.03	I2A-21-50						2.33						4.48E-6	1.1171E+10					
S12A-22-50	1.0030	90.4609	61.07	3.0242	0.3210	12.13	I2A-22-50						1.08						2.14E-6	1.1171E+10					
S12A-23-75	1.0030	57.8965	66.07	3.0242	0.3210	12.03	I2A-23-75						11.65						1.48E-5	1.1171E+10					
S12A-24-75	1.0030	58.3973	67.18	3.0242	0.3210	11.94	I2A-24-75						12.95						1.66E-5	1.1171E+10					

S12A-25-75	1.0030	59.0548	68.42	3.0242	0.3210	11.95	2A-25-75		11.65		1.51E-5	1.1171E+10						
S12A-26-75	1.0030	58.6375	68.97	3.0242	0.3210	11.95	2A-26-75		13.72		1.76E-5	1.1171E+10						
S12A-27-75	1.0030	60.3402	75.11	3.0242	0.3210	12.13	2A-27-75		9.88		1.30E-5	1.1171E+10						
S12A-28-75	1.0030	59.9357	80.08	3.0242	0.3210	12.02	2A-28-75		8.82		1.16E-5	1.1171E+10						
S12A-29-75	1.0030	87.1867	82.13	3.0242	0.3210	12.13	2A-29-75		6.90		1.32E-5	1.1171E+10						
S12A-30-75	1.0030	87.2583	83.14	3.0242	0.3210	12.13	2A-30-75		6.00		1.15E-5	1.1171E+10						
S12A-31-75	1.0030	88.5699	87.07	3.0242	0.3210	12.12	2A-31-75		5.78		1.12E-5	1.1171E+10						
S12A-32-75	1.0030	88.5232	89.05	3.0242	0.3210	12.19	2A-32-75		4.26		8.26E-6	1.1171E+10						
S12A-33-75	1.0030	89.6452	94.02	3.0242	0.3210	12.11	2A-33-75		9.84		1.89E-5	1.1171E+10						
S12A-34-75	1.0030	85.1781	122.02	3.0242	0.3210	12.04	2A-34-75		5.03		9.37E-6	1.1171E+10						
S12A-35-75	1.0030	79.4335	173.07	3.0242	0.3210	12.07	2A-35-75		4.35		7.57E-6	1.1171E+10						
S12A-36-75	1.0030	80.0134	262.01	3.0242	0.3210	12.11	2A-36-75	0.04	0.11	11.20	2.06E-7	1.23E-7	1.98E-5	1.1171E+10				
S12A-37-75	1.0030	67.7997	362.00	3.0242	0.3210	11.97	2A-37-75	0.87	0.25	0.24	0.81	7.73	8.68E-7	1.03E-6	8.29E-7	7.83E-7	1.15E-5	1.1171E+10
S12A-38-75	1.0030	43.3358	425.10	3.0242	0.3210	11.94	2A-38-75	0.38	0.10	0.06	0.15	4.28	2.39E-7	2.66E-7	1.35E-7	9.39E-8	4.06E-6	1.1171E+10
S12A-39-75	1.0030	53.6709	515.02	3.0242	0.3210	12.00	2A-39-75	0.36	0.06	0.04	0.06	4.22	2.85E-7	2.03E-7	1.17E-7	4.90E-8	4.96E-6	1.1171E+10
S12A-43-75	1.0030	230.6800	535.95	3.0242	0.3210	11.77	2A-63-75	0.45	0.04	0.02	0.13	1.80	1.53E-6	5.53E-7	2.97E-7	4.27E-7	8.10E-6	1.1171E+10
S12A-64-75	1.0030	234.8925	542.01	3.0242	0.3210	11.92	2A-64-75	0.40	0.03	0.02	0.08	2.05	1.36E-6	4.13E-7	2.77E-7	2.73E-7	1.06E-5	1.1171E+10
% loss	0.004		0.2	Angstroms								average 75°C	1.20E-5					

Appendix D

Ce-U Single Phase Pyrochlore

Pu Dissolution Project (Ca-Ti-Ce-Gd-Hf-U samples)

Experiments Started on : 8/4/1998 10:00:00 PM
Experiments Terminated on : 12/3/1998 8:45:00 AM

pH 2-12

Pyrochlore

Duration: 121 days

Sample: Ca-Ti-Ce-Gd-Hf-U Ceramic P137

Starting SA= 0.346 m^2/g
ceramic density 6.1 g/cm^3

6.10E-12 g/μ^3

Element	WtFrac	Element	Element	Surface Area Calculation
U	0.2138	U	assume spherical particles	
Ce	0.0686	Ce	diameter(microns) =	2.84
Ca	0.0749	Ca	num.particles/g =	1.36E+10
Ti	0.2170	Ti		
Hf	0.1061	Hf		
Gd	0.0705	Gd		

0.7509

Formulae for cell entries

Net Rate: ppb * 0.001 * mL/day * 0.000001/S.A./ wt. frac.

Mass glass: init. wt. - (days elapsed * mL/day * 0.001*((ppbU*wt. frac.)+(ppbCe*wt.frac.)+...)*0.000001

Diameter: 2^((wt.(t))^0.75/3.14159/density(g/cu.mic.)/#particles)^(1/3)

Note that initial diameter is assumed to be the same for all runs.

Surface area: #particles*4*3.14159*((diam./2)^2)/10^12

particles: wt. glass * # particles/gram

Note that value is kept constant throughout a run.

25 C data pH 2	Mass Ceramics (g)	Flow Rate (mL/day)	Run time (days)	Diameter (microns)	Surf. Area (sq. m)	25 C corrected for dilution and BLANKS IF APPLICABLE (Gd and Hf data)												#Particles		
						pH	iH	Ca	Tl	Ce	Gd	Hf	U	IR-C g/m^2/day	NR-Tl	NR-Ce	NR-Gd	NR-Hf	NR-U	
start	0.886438		82.75	2.832644	0.30781		sta	ppb	ppb	ppb	ppb	ppb	ppb	6.30E-6	2.23E-6	2.01E-6	4.23E-7		1.2211E+10	
S01-40-25	0.8864	45.2380	84.91	2.8326	0.30781	1.77	-40-25	9.2946	1.0388	0.9626	0.2956								1.2211E+10	
S01-41-25	0.8864	50.2469	86.99	2.8326	0.30780	1.92	-41-25	4.5553	0.8803	0.6971	0.3051								1.2211E+10	
S01-42-25	0.8864	51.2982	91.01	2.8326	0.30780	1.83	-42-25	3.0037	3.5670	0.7381	0.3179								1.2211E+10	
S01-43-25	0.8864	51.3888	93.96	2.8326	0.30780	1.98	-43-25	2.3488	2.9734	0.7286	0.4337								1.2211E+10	
S01-44-25	0.8864	51.0623	100.89	2.8326	0.30780	1.97	-44-25	1.8822		0.5978	0.5547								1.2211E+10	
S01-45-25	0.8864	95.2394	106.00	2.8326	0.30780	1.72	-45-25			0.4494	0.4446								1.2211E+10	
S01-46-25	0.8864	98.3410	112.81	2.8326	0.30779	1.89	-46-25			0.4871	0.4056								1.2211E+10	
S01-47-25	0.8864	98.2625	120.89	2.832561	0.30779	2.10	-47-25			0.6410	0.5786								1.2211E+10	
25 C data pH 4	Mass Ceramics (g)	Flow Rate (mL/day)	Run time (days)	Diameter (microns)	Surf. Area (sq. m)	25 C data												#Particles		
start	0.886438		82.75	2.8326	0.30918		sta	ppb	ppb	ppb	ppb	ppb	ppb	9.7080	4.43E-5	2.86E-5	6.40E-6		1.2265E+10	
S02-40-25	0.8864	43.6071	84.91	2.8284	0.30826	4.01	-40-25		21.5303	13.3190				4.3617	8.12E-7	2.52E-5	1.28E-5		1.2265E+10	
S02-41-25	0.8864	48.0153	86.99	2.8284	0.30826	3.99	-41-25	1.1308	11.0853	5.8131									1.2265E+10	
S02-42-25	0.8864	48.0667	91.01	2.8284	0.30826	3.98	-42-25		7.0886	3.2552				2.5730		1.81E-5	7.20E-6		1.2265E+10	
S02-43-25	0.8864	48.2206	93.96	2.8284	0.30826	3.98	-43-25		5.9668	2.6039				2.1111		1.38E-5	5.78E-6		1.2265E+10	
S02-44-25	0.8864	47.8477	100.89	2.8284	0.30825	4.02	-44-25		4.4226	1.6875				1.5909		1.00E-5	3.72E-6		1.2265E+10	
S02-45-25	0.8864	85.3079	106.00	2.8284	0.30825	3.82	-45-25		2.5360	0.9340				1.0150		1.02E-5	3.87E-6		1.2265E+10	
S02-46-25	0.8864	85.2472	112.81	2.8284	0.30825	3.76	-46-25		2.1468	0.7327						8.65E-6	2.87E-6		1.2265E+10	
S02-47-25	0.8864	84.9199	120.89	2.82839	0.30825	4.09	-47-25		1.8594	0.6420						7.47E-6	2.51E-6		1.2265E+10	
25 C data pH 6	Mass Ceramics (g)	Flow Rate (mL/day)	Run time (days)	Diameter (microns)	Surf. Area (sq. m)	25 C data												#Particles		
start	0.897960		82.75	2.8385	0.31112		sta	ppb	ppb	ppb	ppb	ppb	ppb	21.7998	4.55E-5	6.48E-5	1.43E-5		1.2293E+10	
S03-40-25	0.8979	43.5866	84.91	2.8385	0.31112	5.78	-40-25		22.2617	32.6073				13.1896		2.98E-5	4.50E-5		9.27E-6	1.2293E+10
S03-41-25	0.8979	46.7460	86.99	2.8385	0.3111	5.73	-41-25		13.5129	21.1247				8.2854		1.69E-5	2.36E-5		5.54E-6	1.2293E+10
S03-42-25	0.8979	44.5144	91.01	2.8385	0.3111	5.73	-42-25		8.1136	11.6270						1.60E-5	2.11E-5		5.23E-6	1.2293E+10
S03-43-25	0.8979	42.2447	93.96	2.8385	0.3111	5.89	-43-25		8.0683	10.9409				8.2428		1.71E-5	2.13E-5		5.29E-6	1.2293E+10
S03-44-25	0.8978	40.3958	100.89	2.8384	0.3111	5.86	-44-25		9.0240	11.5897				8.7167		1.71E-5	2.13E-5		5.58E-6	1.2293E+10
S03-45-25	0.8978	72.9202	106.00	2.8384	0.3111	5.75	-45-25		6.4415	7.6106				5.8992		2.20E-5	2.53E-5		6.58E-6	1.2293E+10

S03-46-25	0.8978	68.9226	112.81	2.8383	0.3111	5.47	-46-25		4.2424	4.4140		4.0125	1.37E-5	1.39E-5		4.16E-6	1.2293E+10
S03-47-25	0.8977	67.7020	120.89	2.8383	0.3111	5.80	-47-25		3.1841	3.2047		4.6376	1.01E-5	9.89E-6		4.72E-6	1.2293E+10

25 C data pH 8	Mass Ceramics (g)	Flow Rate (mL/day)	Run time (days)	Diameter (microns)	Surf. Area (sq. m)	25 C data											#Particles
-------------------	----------------------	-----------------------	--------------------	-----------------------	-----------------------	-----------	--	--	--	--	--	--	--	--	--	--	------------

start	0.900809		82.75	2.8426	0.3117				sta	ppb	ppb	ppb	ppb	ppb	ppb	ppb	g/m^2/day
S04-40-25	0.9008	41.1878	84.91	2.8426	0.3117	7.70	-40-25					2.9245					1.2279E+10
S04-41-25	0.9008	43.0195	86.99	2.8426	0.3117	7.62	-41-25					2.5076					1.2279E+10
S04-42-25	0.9008	40.3834	91.01	2.8426	0.3117	7.85	-42-25					2.1983					1.2279E+10
S04-43-25	0.9008	38.6884	93.96	2.8426	0.3117	7.56	-43-25					2.8273					1.2279E+10
S04-44-25	0.9008	36.4470	100.89	2.8426	0.3117	7.52	-44-25					1.9288					1.2279E+10
S04-45-25	0.9008	55.3873	108.00	2.8426	0.3117	7.65	-45-25					1.4162					1.2279E+10
S04-46-25	0.9008	43.6846	112.81	2.8426	0.3117	7.35	-46-25					1.5285					1.2279E+10
S04-47-25	0.9008	39.9314	120.89	2.8426	0.3117	7.41	-47-25					1.3442					1.2279E+10

25 C data	Mass Ceramics	Flow Rate	Run time	Diameter	Surf. Area	25 C data														
pH 10	(g)	(mL/day)	(days)	(microns)	(sq. m)	pH	H	Ca	Tl	Ce	Gd	Hf	U	IR-C	NR-Tl	NR-Ce	NR-Gd	NR-Hf	NR-U	#Particles
start	0.895347		82.750694	2.842103	0.3098	sta	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	1.2211E+10	
S05-40-25	0.8953	48.0188	84.91	2.8421	0.3099	9.85	-40-25		0.7675	0.1179	0.0743	4.8262		1.73E-6	2.59E-7	1.09E-7	3.50E-6	1.2211E+10		
S05-41-25	0.8953	54.0453	86.99	2.8421	0.3099	9.90	-41-25		0.3374	-0.0166	0.0348	3.9911		8.58E-7	-4.10E-8	5.71E-8	3.26E-6	1.2211E+10		
S05-42-25	0.8953		91.01	2.8421	0.3099	S05-42-25													1.2211E+10	
S05-43-25	0.8953	54.6277	93.96	2.8421	0.3099	10.05	-43-25		0.3457		0.0357	3.3741		8.88E-7		5.93E-8	2.78E-6	1.2211E+10		
S05-44-25	0.8953	54.9258	100.89	2.8421	0.3099	9.85	-44-25		0.2907		0.0574	3.2136		7.51E-7		9.59E-8	2.66E-6	1.2211E+10		
S05-45-25	0.8953	101.7593	106.00	2.8420	0.3099	10.13	-45-25				0.0181	2.5079				5.59E-8	3.85E-6	1.2211E+10		
S05-46-25	0.8953	104.9642	112.81	2.8420	0.3098	9.86	-46-25		0.2551		0.0146	2.6766		1.26E-6		4.66E-8	4.24E-6	1.2211E+10		
S05-47-25	0.8952	104.8761	120.89	2.84197	0.3098	9.97	-47-25	tube leaked			0.0036	2.6419				1.16E-8	4.18E-6	1.2211E+10		
25 C data	Mass Ceramics	Flow Rate	Run time	Diameter	Surf. Area	25 C data													3.50E-6	1.2211E+10
pH 12	(g)	(mL/day)	(days)	(microns)	(sq. m)	pH	H	Ca	Tl	Ce	Gd	Hf	U	IR-C	NR-Tl	NR-Ce	NR-Gd	NR-Hf	NR-U	#Particles

start	0.908598		82.75	2.841333	0.3097				sta	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	1.2211E+10	
S06-40-25	0.9086	49.2770	84.91	2.8560	0.3129	12.00	-40-25					5.8740						4.37E-6	1.2211E+10	
S06-41-25	0.9086	54.8060	86.99	2.8560	0.3129	12.02	-41-25					4.0767						3.34E-6	1.2211E+10	
S06-42-25	0.9086	56.0183	91.01	2.8560	0.3129	12.06	-42-25					2.8516						2.39E-6	1.2211E+10	
S06-43-25	0.9086	55.2084	93.96	2.8560	0.3129	12.04	-43-25					2.4844						2.05E-6	1.2211E+10	
S06-44-25	0.9086	56.3563	100.89	2.8560	0.3129	12.03	-44-25					1.9570						1.65E-6	1.2211E+10	
S06-45-25	0.9085	104.6301	106.00	2.8560	0.3129	12.09	-45-25					1.5433						2.41E-6	1.2211E+10	
S06-46-25	0.9085	108.0878	112.81	2.8560	0.3129	12.10	-46-25					1.0712						1.73E-6	1.2211E+10	
S06-47-25	0.9085	107.8304	120.89	2.855968	0.3129	12.21	-47-25					1.2156						1.96E-6	1.2211E+10	
25 C data	Mass Ceramics	Flow Rate	Run time	Diameter	Surf. Area	25 C data													2.49E-6	1.2211E+10
pH 12	(g)	(mL/day)	(days)	(microns)	(sq. m)	pH	H	Ca	Tl	Ce	Gd	Hf	U	IR-C	NR-Tl	NR-Ce	NR-Gd	NR-Hf	NR-U	#Particles

Pu Dissolution Project (Ca-Ti-Ce-Gd-Hf-U samples) pH 2-12
 Experiments Started on : 8/4/1998 10:00:00 PM
 Experiments Terminated on : 12/21/2000 3:50:00 PM

Pyrochlore

Duration: 870 days

Sample: Ca-Ti-Ce-Gd-Hf-U Ceramic P137

Starting SA= 0.346 m^2/g

ceramic density 6.1 g/cm^3

6.10E-12 g/μ^3

Element WtFrac Element		Surface Area Calculation assume spherical particles diameter(microns) = 2.84 num.particles/g = 1.3628E+10											
U	0.2138												
Ce	0.0686												
Ca	0.0749												
Ti	0.2170												
Hf	0.1061												
Gd	0.0705												
	0.7509												

Mass

75 C data	Ceramics	Flow Rate	Run time	Diameter	Surf. Area	pH	75 C data	corrected for dilution and BLANKS IF APPLICABLE (Gd and Hf data)												#Particles
								Ca	Ti	Ce	Gd	Hf	U	NR-Ca	NR-Ti	NR-Ce	NR-Gd	NR-Hf	NR-U	
start	0.8925	41.8771	2.8391	0.30922	2.16	start	ppb	ppb	ppb	ppb	ppb	ppb	g/m^2/day	g/m^2/day	day	g/m^2/day	g/m^2/day	g/m^2/day	1.221E+10	
S01-28-75	0.8910	36.6603	47.84	2.8375	0.30885	1.92	S01-28-75	423	185	195	182.18	0.5	477.16	6.70E-4	1.01E-4	3.37E-4	3.08E-4	5.58E-7	2.65E-4	1.221E+10
S01-29-75	0.8908	33.5745	48.82	2.8373	0.30881	1.90	S01-29-75	361	206	152	137.81	0.4	372.98	5.24E-4	1.03E-4	2.41E-4	2.12E-4	4.18E-7	1.90E-4	1.221E+10
S01-30-75	0.8906	35.3704	49.83	2.8371	0.30877	1.91	S01-30-75	336	188	127	116.59	0.4	320.80	5.14E-4	9.92E-5	2.11E-4	1.89E-4	4.23E-7	1.72E-4	1.221E+10
S01-31-75	0.8905	30.7869	50.80	2.8369	0.30874	2.00	S01-31-75	433	193	128	117.75	0.3	318.11	5.78E-4	8.87E-5	1.86E-4	1.67E-4	3.18E-7	1.48E-4	1.221E+10
S01-32-75	0.8899	36.3332	54.93	2.8363	0.30861	1.91	S01-32-75	233	155	92	85.83		237.34	3.66E-4	8.41E-5	1.58E-4	1.43E-4	3.11E-4	1.221E+10	
S01-33-75	0.8894	34.7144	58.96	2.8358	0.30850	1.71	S01-33-75	327	144	88	82.27		234.25	4.91E-4	7.46E-5	1.44E-4	1.31E-4	1.23E-4	1.221E+10	
S01-34-75	0.8889	32.5009	62.90	2.8353	0.30839	1.89	S01-34-75	389	147	89	86.66		241.72	5.47E-4	7.14E-5	1.37E-4	1.29E-4	1.19E-4	1.221E+10	
S01-35-75	0.8886	30.3649	66.02	2.8349	0.30830	1.91	S01-35-75	345	141	90	92.41		252.42	4.54E-4	6.40E-5	1.29E-4	1.16E-4	1.221E+10		
S01-36-75	0.8881	71.5717	69.87	2.8344	0.30819	1.87	S01-36-75		89	47	38.53		121.52	9.53E-5	1.59E-4	1.27E-4	1.32E-4	1.221E+10		
S01-37-75	0.8877	79.1698	72.86	2.8340	0.30809	1.89	S01-37-75		77	44	37.94		115.11	9.07E-5	1.63E-4	1.38E-4	1.38E-4	1.221E+10		
S01-38-75	0.8870	79.2656	77.88	2.8332	0.30794	1.68	S01-38-75		77	42	35.33		109.30	9.14E-5	1.56E-4	1.29E-4	1.32E-4	1.221E+10		
S01-39-75	0.8864	76.9922	82.75	2.8326	0.30781	1.80	S01-39-75		68	39	32.24		99.44	7.87E-5	1.42E-4	1.14E-4	1.16E-4	1.221E+10		
				134.68	2.8322															
S01-52-75	0.8733	28.5547	282.84	2.8186	0.30477	1.90	S01-52-75			156	90.30		203.79		2.11E-4	1.19E-4	8.84E-5	1.221E+10		
S01-53-75	0.8712	33.7245	337.94	2.8163	0.30426	1.85	S01-53-75			52	30.11		75.85		8.35E-5	4.73E-5	3.93E-5	1.221E+10		
S01-55-75	0.8698	27.8676	377.89	2.8148	0.30395	2.04	S01-55-75			43	28.00		78.85		5.75E-5	3.84E-5	3.38E-5	1.221E+10		
S01-57-75	0.8690	39.3045	426.81	2.8140	0.30376	1.84	S01-57-75			25	14	7.90	27.30		1.47E-5	2.64E-5	1.45E-5	1.65E-5	1.221E+10	
S01-58-75	0.8677	37.9332	468.91	2.8125	0.30345	1.89	S01-58-75			34	16	15.29	54.32		1.98E-5	2.99E-5	2.71E-5	3.17E-5	1.221E+10	
S01-59-75	0.8645	38.8876	553.85	2.8091	0.30272	1.81	S01-59-75			46	17	17.31	0.14	61.67	2.73E-5	3.11E-5	3.14E-5	1.71E-7	3.69E-5	1.221E+10
S01-60-75	0.8629	40.9995	636.89	2.8073	0.30233	2.08	S01-60-75			22	11	11.30	31.58		1.36E-5	2.08E-5	2.17E-5	2.00E-5	1.221E+10	
S01-61-75	0.8623	49.0074	655.81	2.8067	0.30220	1.90	S01-61-75			24	8	10.92	2.04	38.47	1.80E-5	1.93E-5	2.51E-5	3.11E-6	2.92E-5	1.221E+10
S01-62-75	0.8578	42.8937	807.13	2.8019	0.30115	1.89	S01-62-75			33	10	12.94	3.16	44.66	2.17E-5	2.02E-5	2.61E-5	4.23E-6	2.96E-5	1.221E+10
S01-66-75	0.8554	306.2190	869.73	2.7992	0.30058	1.79	S01-66-75			7	4	2.72	5.65	8.16	3.48E-5	5.65E-5	3.92E-5	5.41E-5	3.88E-5	1.221E+10
% loss	4.16			199.6	Angstroms											average	9.75E-5			

75 C data	Ceramics	Flow Rate	Run time	Diameter	Surf. Area	pH	75 C data	corrected for dilution and BLANKS IF APPLICABLE (Gd and Hf data)												#Particles
								pH 4	Ca	Ti	Ce	Gd	Hf	U	NR-Ca	NR-Ti	NR-Ce	NR-Gd	NR-Hf	NR-U
start	0.8975	41.8771	2.8402	0.31083	3.95	start	ppb	ppb	ppb	ppb	ppb	ppb	ppb	g/m^2/day	g/m^2/day	day	g/m^2/day	g/m^2/day	g/m^2/day	1.227E+10
S02-28-75	0.8964	38.5493	47.84	2.8390	0.31058	4.10	S02-28-75	260	24	41.20	314.02	4.30E-4	4.29E-5	7.25E-5	1.82E-4	1.227E+10				
S02-29-75	0.8962	39.2153	48.82	2.8388	0.31053	3.98	S02-29-75	217	44	83.84	397.86	3.66E-4	8.05E-5	1.50E-4	2.35E-4	1.227E+10				
S02-30-75	0.8960	39.0240	49.83	2.8386	0.31048	4.11	S02-30-75	249	58	105.99	375.37	4.17E-4	1.06E-4	1.89E-4	2.21E-4	1.227E+10				
S02-31-75	0.8958	35.2948	50.80	2.8384	0.31043	3.93	S02-31-75	190	64	108.98	7	346.53	2.88E-4	1.07E-4	1.76E-4	7.46E-6	1.84E-4	1.227E+10		
S02-32-75	0.8953	36.8544	54.93	2.8378	0.31031	4.02	S02-32-75	236	60	85.47	242.44	3.73E-4	1.03E-4	1.43E-4	1.34E-4	1.227E+10				
S02-33-75	0.8948	36.9438	58.96	2.8373	0.31020	3.94	S02-33-75	144	53	68.73	196.04	2.29E-4	9.14E-5	1.16E-4	1.09E-4	1.227E+10				
S02-34-75	0.8944	37.2265	62.90	2.8369	0.31011	4.16	S02-34-75	357	50	83.15	177.46	5.72E-4	8.78E-5	1.07E-4	9.96E-5	1.227E+10				
S02-35-75	0.8941	36.6731	66.02	2.8366	0.31005	4.02	S02-35-75	537	47	56.44	165.02	6.47E-4	8.06E-5	9.47E-5	9.13E-5	1.227E+10				
S02-36-75	0.8938	72.4976	69.87	2.8362	0.30996	4.02	S02-36-75	1.58	37	35.71	94.10	1.70E-6	1.25E-4	1.18E-4	1.03E-4	1.227E+10				
S02-37-75	0.8935	78.9481	72.86	2.8359	0.30990	4.02	S02-37-75		26	24.96	73.50		9.76E-5	9.02E-5		8.76E-5	1.227E+10			
S02-38-75	0.8931	84.2736	77.88	2.8355	0.30980	3.89	S02-38-75		24	22.74	66.37		9.48E-5	8.77E-5		8.44E-5	1.227E+10			

S02-39-75	0.8931	0.0000	82.75	2.8355	0.30980	S02-39-75													1.227E+10			
	0.8862		134.6819	2.8282	0.30821														1.227E+10			
S02-52-75	0.8873	50.8724	282.84	2.8293	0.30846	3.94	S02-52-75		12	14.73	37.66		2.90E-5	3.43E-5		2.89E-5		1.227E+10				
S02-53-75	0.8860	52.0330	337.94	2.8280	0.30816	4.02	S02-53-75		11	14.18	29.68		2.80E-5	3.39E-5		2.34E-5		1.227E+10				
S02-55-75	0.8851	52.4929	377.89	2.8270	0.30795	3.98	S02-55-75		9	12.72	28.89		2.28E-5	3.07E-5		2.30E-5		1.227E+10				
S02-57-75	0.8844	52.3000	426.81	2.8263	0.30780	3.73	S02-57-75		6	5.83	15.95		1.40E-5	1.40E-5		1.27E-5		1.227E+10				
S02-58-75	0.8839	48.8308	488.91	2.8258	0.30769	3.94	S02-58-75		6	6.18	16.71		1.24E-5	1.33E-5		1.19E-5		1.227E+10				
S02-59-75	0.8831	43.9948	553.85	2.8249	0.30749	3.87	S02-59-75		6	6.21	15.12		1.18E-5	1.28E-5		1.01E-5		1.227E+10				
S02-60-75	0.8827	35.1107	636.89	2.8244	0.30739	4.17	S02-60-75		3	3.58	9.69		5.70E-6	5.80E-6		5.17E-6		1.227E+10				
S02-61-75	0.8826	50.1804	655.81	2.8243	0.30736	3.88	S02-61-75		0.12	4	2.71	0.05	7.00	8.92E-8	8.45E-8	8.27E-6	8.12E-8	5.35E-6	1.227E+10			
S02-62-75	0.8819	39.5706	807.13	2.8236	0.30720	4.00	S02-62-75		0.24	5	3.37	0.05	7.58	1.39E-7	8.86E-8	6.15E-6	6.05E-8	4.56E-6	1.227E+10			
S02-64-75	0.8818	145.4826	827.91	2.8235	0.30718	3.79	S02-64-75		0.17	3	1.33	0.05	2.37	3.68E-7	1.73E-5	8.93E-6	2.34E-7	5.26E-6	1.227E+10			
S02-65-75	0.8817	92.4880	834.81	2.8234	0.30717	4.11	S02-65-75		0.14	4	2.03	0.06	4.13	1.98E-7	1.80E-5	8.66E-6	1.66E-7	5.82E-6	1.227E+10			
% loss	1.76		83.9		Angstroms									average		7.58E-5						
Mass																						
75 C data	Ceramics	Flow Rate	Run time	Diameter	Surf. Area		75 C data															
pH 6	(g)	(mL/day)	(days)	(microns)	(sq. m)	pH	pH 6	Ca	Ti	Ce	Gd	Hf	U	NR-Ca	NR-Ti	NR-Ce	NR-Gd	NR-Hf	NR-U	#Particles		
start	0.9005	41.8771	2.8412	0.3117	5.60	start	ppb	ppb	ppb	ppb	ppb	ppb	ppb	g/m^2/ day	1.229E+10							
S03-28-75	0.9003	35.7592	47.84	2.8410	0.3117	5.81	S03-28-75	177		1.07	4.07	46.07	2.72E-4	1.79E-6	6.62E-6		2.47E-5		1.229E+10			
S03-29-75	0.9003	37.5137	48.82	2.8410	0.3117	5.61	S03-29-75	299		1.48	5.72	80.33	4.80E-4	2.59E-6	9.76E-6		4.52E-5		1.229E+10			
S03-30-75	0.9002	34.7960	49.83	2.8409	0.3117	5.72	S03-30-75	371		1.67	6.99	93.05	5.54E-4	2.72E-6	1.11E-5		4.88E-5		1.229E+10			
S03-31-75	0.9002	35.3718	50.80	2.8409	0.3117	5.59	S03-31-75	314		2.03	8.29	102.37	4.75E-4	3.36E-6	1.33E-5		5.43E-5		1.229E+10			
S03-32-75	0.8999	37.6173	54.93	2.8406	0.3116	5.75	S03-32-75	178		2.74	11.75	104.52	2.87E-4	4.81E-6	2.01E-5		5.90E-5		1.229E+10			
S03-33-75	0.8997	39.8074	58.96	2.8404	0.3116	5.76	S03-33-75	211		2.90	12.45	90.91	3.61E-4	5.41E-6	2.28E-5		5.45E-5		1.229E+10			
S03-34-75	0.8995	38.8321	62.90	2.8402	0.3115	5.80	S03-34-75	304		3.68	14.19	91.31	5.06E-4	6.89E-6	2.51E-5		5.32E-5		1.229E+10			
S03-35-75	0.8993	37.8746	66.02	2.8400	0.3115	5.57	S03-35-75	86		4.16	17.03	106.27	1.39E-4	7.38E-6	2.94E-5		6.04E-5		1.229E+10			
S03-36-75	0.8989	71.5482	69.87	2.8396	0.3114	5.74	S03-36-75			6.73	15.63	91.47		2.25E-5	5.09E-5		9.83E-5		1.229E+10			
S03-37-75	0.8987	76.1757	72.86	2.8394	0.3113	5.59	S03-37-75			5.79	12.28	62.05		2.07E-5	4.26E-5		7.10E-5		1.229E+10			
S03-38-75	0.8983	82.0269	77.88	2.8389	0.3112	5.74	S03-38-75			7.04	14.05	67.45		2.70E-5	5.25E-5		8.31E-5		1.229E+10			
S03-39-75	0.8980	77.8957	82.75	2.8385	0.3112	5.63	S03-39-75			7.09	13.22	61.35		2.58E-5	4.68E-5		7.16E-5		1.229E+10			
	0.8972	134.6819	2.8377	0.3110															1.229E+10			
S03-52-75	0.8988	46.7337	282.84	2.8373	0.3109	6.44	S03-52-75				0.77	8.31			1.64E-6		5.84E-6		1.229E+10			
S03-53-75	0.8956	49.5058	337.94	2.8361	0.3108	6.35	S03-53-75				2.51	28.96			5.67E-6		2.16E-5		1.229E+10			
S03-55-75	0.8948	42.9175	377.89	2.8353	0.3104	6.02	S03-55-75				2.80	29.50			5.49E-6		1.91E-5		1.229E+10			
S03-57-75	0.8943	36.7105	426.81	2.8347	0.3103	5.77	S03-57-75			1.23	5.59	20.60		2.13E-6	9.38E-6		1.14E-5		1.229E+10			
S03-58-75	0.8940	27.8011	468.91	2.8344	0.3103	5.92	S03-58-75			1.07	3.80	13.81		1.38E-6	4.80E-6		5.75E-6		1.229E+10			
S03-59-75	0.8936	19.4791	553.85	2.8340	0.3102	6.31	S03-59-75			0.21	0.62	3.60		15.75	6.05E-8	5.89E-7	3.21E-6		4.63E-6	1.229E+10		
S03-60-75	0.8935	13.6596	636.89	2.8338	0.3101	6.47	S03-60-75			0.34	0.34	2.07		11.49	6.86E-8	2.21E-7	1.28E-6		2.37E-6	1.229E+10		
S03-61-75	0.8933	23.2294	655.81	2.8336	0.3101	6.22	S03-61-75				0.46	2.80	0.05	24.68		5.07E-7	2.97E-6	3.58E-6		8.65E-6	1.229E+10	
S03-62-75	0.8917	47.9958	807.12	2.8319	0.3097	6.26	S03-62-75			0.27	0.29	1.88	0.07	14.63		1.92E-7	6.52E-7	4.14E-6		1.04E-7	1.229E+10	
S03-64-75	0.8914	126.9389	827.91	2.8317	0.3097	5.96	S03-64-75			0.09	0.34	2.09	0.05	6.04		1.72E-7	2.05E-6	1.22E-5		1.79E-7	1.16E-5	1.229E+10
S03-65-75	0.8914	85.7234	834.91	2.8316	0.3096	6.10	S03-65-75			0.10	0.94	5.07	0.05	4.94		1.32E-7	3.81E-6	1.99E-5		1.20E-7	6.39E-6	1.229E+10
S03-66-75	0.8909	188.5842	869.73	2.8310	0.3095	6.20	S03-66-75			0.11	0.87	3.97	0.05	5.48		2.98E-7	7.74E-6	3.43E-6		2.63E-7	1.56E-5	1.229E+10
% loss	1.07		50.7		Angstroms																	

Mass																							
75 C data	Ceramics	Flow Rate	Run time	Diameter	Surf. Area		75 C data											#Particles					
pH 8	(g)	(mL/day)	(days)	(microns)	(sq. m)	pH	pH 8	Ca	Ti	Ce	Gd	Hf	U	NR-Ca	NR-Ti	NR-Ce g/m^2/day	NR-Gd	NR-Hf	NR-U				
start	0.9009	40.6875	41.88	2.8427	0.3117	7.45	start	ppb	ppb	ppb	ppb	ppb	ppb	g/m^2/day	g/m^2/day	g/m^2/day	g/m^2/day	1.228E+10					
S04-28-75	0.9009	40.6875	47.84	2.8427	0.3117	7.69	S04-28-75	64					2.49	1.12E-4		1.52E-6	1.228E+10						
S04-29-75	0.9009	42.5215	48.82	2.8427	0.3117	7.85	S04-29-75	55					2.68	1.01E-4		1.71E-6	1.228E+10						
S04-30-75	0.9009	42.9128	49.83	2.8427	0.3117	7.62	S04-30-75	80					2.41	1.46E-4		1.55E-6	1.228E+10						
S04-31-75	0.9009	40.4562	50.80	2.8426	0.3117	7.79	S04-31-75	87					2.34	1.51E-4		1.42E-6	1.228E+10						
S04-32-75	0.9009	41.9931	54.93	2.8426	0.3117	7.73	S04-32-75	81					1.55	1.46E-4		9.76E-7	1.228E+10						
S04-33-75	0.9009	41.0107	58.96	2.8426	0.3117	7.65	S04-33-75	124					1.09	2.18E-4		6.70E-7	1.228E+10						
S04-34-75	0.9009	41.5325	62.90	2.8426	0.3117	7.75	S04-34-75	144					1.10	2.56E-4		6.87E-7	1.228E+10						
S04-35-75	0.9009	38.1993	66.02	2.8426	0.3117	7.73	S04-35-75	184					1.20	3.01E-4		6.89E-7	1.228E+10						
S04-36-75	0.9009	72.8334	69.87	2.8426	0.3117	7.71	S04-36-75									0.00E+0	1.228E+10						
S04-37-75	0.9009	82.8069	72.86	2.8426	0.3117	7.84	S04-37-75									0.00E+0	1.228E+10						
S04-38-75	0.9009	81.8454	77.88	2.8426	0.3117	7.80	S04-38-75									0.00E+0	1.228E+10						
S04-39-75	0.9009	77.5224	82.75	2.84264	0.3117	7.88	S04-39-75									0.00E+0	1.228E+10						
	0.900757		134.68	2.8425																			
S04-52-75	0.9002	35.1380	282.84	2.84191	0.3116	7.58	S04-52-75						2.46			4.03E-6	1.228E+10						
S04-53-75	0.8999	39.2529	337.94	2.84161	0.3115	7.64	S04-53-75						8.66			5.11E-6	1.228E+10						
S04-55-75	0.8996	39.8882	377.89	2.84133	0.3114	7.61	S04-55-75						11.36			6.80E-6	1.228E+10						
S04-57-75	0.8995	34.7835	426.81	2.84122	0.3114	7.77	S04-57-75	0.22	0.003	0.01	0.04	3.86		3.53E-7	4.92E-9	1.83E-8	4.40E-8	2.02E-6	1.228E+10				
S04-58-75	0.8994	36.1884	468.91	2.84115	0.3114	7.86	S04-58-75	0.44	0.01	0.02	0.04	2.90		7.40E-7	8.54E-9	3.57E-8	4.53E-8	1.58E-8	1.228E+10				
S04-59-75	0.8994	34.8854	553.85	2.84110	0.3114	7.69	S04-59-75	0.28	0.0025		0.04	1.15		4.52E-7	4.11E-9	4.52E-8	6.02E-7	1.228E+10					
S04-60-75	0.8994	29.3670	636.89	2.84106	0.3114	7.60	S04-60-75	0.26		0.01	0.04	0.91		3.53E-7		1.15E-8	3.85E-8	4.04E-7	1.228E+10				
S04-61-75	0.8994	44.3805	655.81	2.84106	0.3114	7.74	S04-61-75											1.228E+10					
S04-62-75	0.8987	42.0865	807.13	2.84037	0.3112	7.53	S04-62-75		0.79	0.50	0.30	6.93			1.56E-6	9.53E-7	3.78E-7	4.38E-6	1.228E+10				
S04-63-75	0.8984	175.2889	827.91	2.84008	0.3112	7.66	S04-63-75			0.23		4.95				1.80E-6		1.30E-5	1.228E+10				
S04-64-75	0.8984	163.3380	832.84	2.84001	0.3111	7.41	S04-64-75					5.71						1.40E-5	1.228E+10				
% loss	0.28			13.3	Angstroms											average	2.78E-6						
Mass																							
75 C data	Ceramics	Flow Rate	Run time	Diameter	Surf. Area		75 C data											#Particles					
pH 10	(g)	(mL/day)	(days)	(microns)	(sq. m)	pH	pH 10	Ca	Ti	Ce	Gd	Hf	U	NR-Ca	NR-Ti	NR-Ce g/m^2/day	NR-Gd	NR-Hf	NR-U				
start	0.89570	41.87708	2.84248	0.3099	9.81	start	ppb	ppb	ppb	ppb	ppb	ppb	ppb	g/m^2/day	g/m^2/day	g/m^2/day	g/m^2/day	1.221E+10					
S05-28-75	0.8957	38.2431	47.84	2.8425	0.3099	9.62	S05-28-75	332					0.79	0.50	0.30	6.93	5.47E-4	1.42E-6	8.70E-7	3.45E-7	4.00E-6	1.221E+10	
S05-29-75	0.8957	42.9504	48.82	2.8425	0.3099	9.86	S05-29-75	64					0.23			4.95	1.19E-4	4.42E-7			3.21E-6	1.221E+10	
S05-30-75	0.8957	42.0704	49.83	2.8424	0.3099	9.90	S05-30-75	341								5.71	6.18E-4				3.63E-6	1.221E+10	
S05-31-75	0.8957	41.1454	50.80	2.8424	0.3099	9.94	S05-31-75	236								7.59	4.19E-4				4.72E-6	1.221E+10	
S05-32-75	0.8956	41.5266	54.93	2.8424	0.3099	9.87	S05-32-75	95					0.23			13.38	1.89E-4				8.39E-6	1.221E+10	
S05-33-75	0.8956	42.8919	58.96	2.8423	0.3099	9.85	S05-33-75	141					0.21			24.22	2.60E-4				4.04E-7	1.57E-5	1.221E+10
S05-34-75	0.8955	42.0506	62.90	2.8423	0.3099	9.80	S05-34-75	178								17.19	3.23E-4				1.09E-5	1.221E+10	
S05-35-75	0.8955	41.0160	66.02	2.8423	0.3099	9.99	S05-35-75	tube leaked					0.41	0.26	0.38	10.20		1.45E-6	9.05E-7	8.71E-7	1.17E-5		1.221E+10
S05-36-75	0.8955	76.1329	69.87	2.8422	0.3099	9.78	S05-36-75						0.34			8.78					1.221E+10		
S05-37-75	0.8954	88.3574	72.86	2.8422	0.3099	9.97	S05-37-75						0.34			8.78					9.12E-7	1.17E-5	1.221E+10
S05-38-75	0.8954	96.0400	77.88	2.8422	0.3099	9.79	S05-38-75						0.34			7.04					9.92E-7	1.02E-5	1.221E+10
S05-39-75	0.8953	90.3981	82.75	2.8421	0.3099	10.01	S05-39-75						0.38			7.30		1.61E-6	9.26E-7	9.96E-6	1.221E+10		
	0.895132	134.68	2.84175	0.3098																		1.221E+10	
S05-52-75	0.8946	44.6010	282.84	2.8413	0.3097	9.80	S05-52-75						0.54			5.56		1.14E-6			3.74E-6	1.221E+10	
S05-53-75	0.8943	48.8842	337.94	2.8410	0.3096	9.79	S05-53-75									5.70					4.21E-6	1.221E+10	
S05-55-75	0.8942	47.6682	377.89	2.8409	0.3096	9.80	S05-55-75									3.41					2.46E-6	1.221E+10	
S05-57-75	0.8942	45.5524	426.81	2.8409	0.3098	9.82	S05-57-75									1.89					1.30E-6	1.221E+10	
S05-58-75	0.8941	46.5505	468.91	2.8407	0.3096	9.86	S05-58-75									4.29					3.02E-6	1.221E+10	
S05-59-75	0.8937	35.9211	553.85	2.8404	0.3095	9.88	S05-59-75	0.25								7.72	4.15E-7				4.19E-6	1.221E+10	
S05-60-75	0.8935	32.9732	636.89	2.8401	0.3094	9.40	S05-60-75	0.18								5.89	2.78E-7				2.94E-6	1.221E+10	
S05-61-75	0.8934	41.9876	655.81	2.8400	0.3094	9.85	S05-61-75	0.92	0.04	0.03	0.05	7.61		1.82E-6	6.98E-8	5.82E-8	6.83E-8	4.83E-6	1.221E+10				
S05-62-75	0.8931	36.1407	807.13	2.8397	0.3093	9.88	S05-62-75	0.71	0.03	0.03	0.05	3.37		1.21E-6	4.38E-8	4.26E-8	5.55E-8	1.84E-6	1.221E+10				
S05-63-75	0.8929	190.4620	827.91	2.8395	0.3093	9.24	S05-63-75	0.47	0.04	0.02	0.05	3.95		4.25E-6	3.62E-7	1.80E-7	3.10E-7	1.14E-5	1.221E+10				
S05-64-75	0.8928	194.8574	832.84	2.8394	0.3093	9.33	S05-64-75	0.47	0.02	0.02	0.04	4.24		4.34E-6	2.04E-7	2.21E-7	2.86E-7	1.25E-5	1.221E+10				
% loss	0.33			15.4	Angstroms											average	8.86E-6						

Appendix E

Ce-U Single Phase Brannerite

Pu Dissolution Project (Ti-U samples)										pH 2-12	Brannerite							
Experiments Started on :	5/23/1999	3:03:00 PM																
Experiments terminated on :	11/16/2000	4:13:00 PM									Duration:	544	days					
Sample: Ca-Ti-Ce-Gd-Hf-U Ceramic P137																		
Starting SA=	0.2137	m^2/g				aqua=estimate												
ceramic density	5.4	g/cm^3				5.400E-12	g/μ^3											
Element	WtFrac Element																	
U	0.5388																	
Ti	0.2331																	
25 C data	Mass Ceramics	Flow Rate	Run time	Diameter	Surf. Area													
pH 2	(g)	(mL/day)	(days)	(microns)	(sq. m)	pH	pH 2											
Start	1.56700		0.00	5.1994	0.33487	2.06	start	Ti	U	NR-Ti	NR-U	#Particles						
BR1-1-25	1.5668	51.7718	0.39	5.1991	0.33484	2.06	BR1-1-25	ppb	ppb	g/m^2/day	g/m^2/day	3942921003						
BR1-2-25	1.5665	50.6949	3.00	5.1988	0.33480	2.04	BR1-2-25	281.00	382.16	1.70E-4	1.07E-4	3942921003						
BR1-3-25	1.5665	-32.5849	4.03	5.1988	0.33480	0.00	BR1-3-25					3942921003						
BR1-4-25	1.5664	51.6624	5.03	5.1987	0.33478	1.99	BR1-4-25	210.43	346.24	1.39E-4	9.92E-5	3942921003						
BR1-5-25	1.5661	49.3045	11.18	5.1984	0.33474	1.98	BR1-5-25	92.12	187.34	5.82E-5	5.12E-5	3942921003						
BR1-6-25	1.5659	49.1423	13.16	5.1982	0.33472	2.06	BR1-6-25	136.12	279.07	8.57E-5	7.80E-5	3942921003						
BR1-7-25	1.5655	86.7229	17.99	5.1978	0.33466	2.01	BR1-7-25	78.57	163.92	8.73E-5	7.88E-5	3942921003						
BR1-8-25	1.5655	94.4576	19.04	5.1977	0.33465	2.05	BR1-8-25	64.89	137.12	7.86E-5	7.18E-5	3942921003						
BR1-9-25	1.5654	94.5219	20.01	5.1976	0.33464	2.01	BR1-9-25	62.69	147.78	7.80E-5	7.75E-5	3942921003						
BR1-10-25	1.5651	93.8979	23.96	5.1973	0.33460	2.03	BR1-10-25	62.47	135.76	7.52E-5	7.07E-5	3942921003						
BR1-11-25	1.5650	93.4294	26.01	5.1971	0.33458	2.00	BR1-11-25	59.11	141.94	7.08E-5	7.36E-5	3942921003						
BR1-12-50	1.5594	87.4582	38.12	5.1910	0.33379	1.63	BR1-12-50	113.24	940.56	1.27E-4	4.56E-4	3942921003						
BR1-13-50	1.5592	85.7422	39.09	5.1907	0.33375	1.75	BR1-13-50	97.20	591.83	1.07E-4	2.82E-4	3942921003						
BR1-14-50	1.5589	86.9334	40.16	5.1904	0.33371	2.04	BR1-14-50	105.82	505.14	1.18E-4	2.44E-4	3942921003						
BR1-15-50	1.5587	84.4808	41.11	5.1902	0.33369	2.01	BR1-15-50	113.55	590.49	9.41E-5	2.12E-4	3942921003						
BR1-16-50	1.5579	80.6114	46.03	5.1893	0.33357	2.01	BR1-16-50	106.26	504.76	8.28E-5	1.70E-4	3942921003						
BR1-17-50	1.5575	56.6986	48.12	5.1889	0.33352	1.88	BR1-17-50	90.49	482.82	6.60E-5	1.52E-4	3942921003						
BR1-18-50	1.5570	101.5736	51.98	5.1883	0.33344	2.01	BR1-18-50	63.07	246.84	8.24E-5	1.40E-4	3942921003						
BR1-19-50	1.5569	103.4462	52.97	5.1882	0.33342	1.99	BR1-19-50	52.18	252.28	6.94E-5	1.45E-4	3942921003						
BR1-20-50	1.5566	101.7446	55.27	5.1878	0.33338	2.05	BR1-20-50	46.13	241.88	6.04E-5	1.37E-4	3942921003						
BR1-21-50	1.5560	103.2788	58.99	5.1872	0.33330	1.99	BR1-21-50	51.68	284.35	6.87E-5	1.52E-4	3942921003						
BR1-22-50	1.5557	104.0408	61.07	5.1869	0.33326	1.89	BR1-22-50	30.42	202.29	4.07E-5	1.17E-4	3942921003						
BR1-23-75	1.5533	59.6190	66.07	5.1842	0.33291	1.95	BR1-23-75	60.37	1466.74	4.63E-5	4.87E-4	3942921003						
BR1-24-75	1.5528	57.0763	67.18	5.1836	0.33284	1.92	BR1-24-75	59.52	1515.98	4.38E-5	4.82E-4	3942921003						
BR1-25-75	1.5522	57.1373	68.42	5.1829	0.33275	1.88	BR1-25-75	55.57	1504.83	4.09E-5	4.79E-4	3942921003						
BR1-26-75	1.5519	58.1764	68.97	5.1827	0.33272	2.09	BR1-26-75	50.85	1471.31	3.81E-5	4.77E-4	3942921003						
BR1-27-75	1.5489	57.9365	75.11	5.1793	0.33228	2.02	BR1-27-75	42.46	1537.84	3.17E-5	4.97E-4	3942921003						
BR1-28-75	1.5464	55.7072	80.08	5.1765	0.33192	2.01	BR1-28-75	37.00	1613.60	2.66E-5	5.02E-4	3942921003						
BR1-29-75	1.5452	97.0727	82.13	5.1752	0.33175	2.05	BR1-29-75	31.54	1053.25	3.98E-5	5.72E-4	3942921003						
BR1-30-75	1.5447	98.2821	83.14	5.1746	0.33168	1.96	BR1-30-75	29.09	968.21	3.70E-5	5.32E-4	3942921003						
BR1-31-75	1.5424	97.9563	87.07	5.1721	0.33136	2.06	BR1-31-75	27.01	1033.78	3.42E-5	5.87E-4	3942921003						
BR1-32-75	1.5414	97.7885	89.05	5.1709	0.33121	2.03	BR1-32-75	22.67	951.17	2.87E-5	5.21E-4	3942921003						
BR1-33-75	1.5388	96.0852	94.02	5.1678	0.33081	1.90	BR1-33-75	28.50	1042.21	3.30E-5	5.81E-4	3942921003						
BR1-34-75	1.5214	97.1694	122.02	5.1485	0.32834	1.89	BR1-34-75	23.25	1128.01	2.93E-5	6.15E-4	3942921003						
BR1-35-75	1.4822	95.1717	173.07	5.1038	0.32267	1.80	BR1-35-75	15.47	1428.45	1.92E-5	7.68E-4	3942921003						
BR1-36-75	1.4077	95.8209	262.01	5.0168	0.31178	1.80	BR1-36-75	11.43	1518.15	1.46E-5	8.37E-4	3942921003						
BR1-37-75	1.3292	100.3605	362.00	4.9218	0.30007	2.10	BR1-37-75	6.97	1314.68	9.63E-6	7.85E-4	3942921003						
BR1-38-75	1.2776	84.2639	425.10	4.8573	0.29225	2.03	BR1-38-75	7.71	1568.98	9.28E-6	8.18E-4	3942921003						
BR1-39-75	1.2103	94.9258	515.02	4.7705	0.28190	1.97	BR1-39-75	7.53	1241.50	1.05E-5	7.48E-4	3942921003						
BR1-40-75	1.1938	317.0885	535.95	4.7487	0.27933	1.84	BR1-40-75	6.52	377.55	3.15E-5	7.88E-4	3942921003						
BR1-41-75	1.1888	298.4172	542.01	4.7420	0.27854	2.13	BR1-41-75	6.31	420.30	2.89E-5	8.33E-4	3942921003						
% loss	24.14			2287.0	Angstroms													
25 C data	Mass Ceramics	Flow Rate	Run time	Diameter	Surf. Area	pH	pH 4	Ti	U	NR-Ti	NR-U	#Particles						
pH 4	(g)	(mL/day)	(days)	(microns)	(sq. m)	pH	pH 4	Start	ppb	ppb	g/m^2/day	g/m^2/day	3910210107					
Start	1.55400		0.00	5.1994	0.33209	3.94												

BR2-1-25	1.5538	52.3513	0.39	5.1992	0.33206	4.00	BR2-1-25	11.02	1742.68	7.45E-6	5.10E-4	3910210107
BR2-2-25	1.5535	51.3138	3.00	5.1988	0.33202	3.96	BR2-2-25	11.27	412.38	7.47E-6	1.18E-4	3910210107
BR2-3-25	1.5534	51.0824	4.03	5.1988	0.33201	3.96	BR2-3-25	10.53	196.20	6.95E-6	5.80E-5	3910210107
BR2-4-25	1.5534	50.3895	5.03	5.1987	0.33200	3.93	BR2-4-25	9.29	206.57	6.05E-6	5.82E-5	3910210107
BR2-5-25	1.5532	49.0281	11.18	5.1985	0.33198	3.92	BR2-5-25	7.64	100.52	4.84E-6	2.76E-5	3910210107
BR2-6-25	1.5531	48.8833	13.16	5.1984	0.33197	3.99	BR2-6-25	7.99	139.11	5.05E-6	3.80E-5	3910210107
BR2-7-25	1.5529	86.7710	17.99	5.1982	0.33194	3.87	BR2-7-25	6.40	89.05	7.17E-6	4.32E-5	3910210107
BR2-8-25	1.5529	94.5882	19.04	5.1981	0.33193	3.98	BR2-8-25	5.41	79.66	6.62E-6	4.21E-5	3910210107
BR2-9-25	1.5528	94.8459	20.01	5.1981	0.33192	3.94	BR2-9-25	5.30	82.75	6.49E-6	4.39E-5	3910210107
BR2-10-25	1.5527	94.3396	23.96	5.1979	0.33190	3.94	BR2-10-25	5.21	79.41	6.35E-6	4.19E-5	3910210107
BR2-11-25	1.5526	95.0272	26.01	5.1978	0.33189	3.95	BR2-11-25	4.56	82.79	5.60E-6	4.40E-5	3910210107
BR2-12-50	1.5474	88.8940	38.12	5.1921	0.33115	3.62	BR2-12-50	2.78	854.05	3.20E-6	4.25E-4	3910210107
BR2-13-50	1.5471	87.2304	39.09	5.1917	0.33111	3.81	BR2-13-50	2.17	657.51	2.45E-6	3.21E-4	3910210107
BR2-14-50	1.5468	88.3766	40.16	5.1914	0.33106	3.98	BR2-14-50	1.70	614.99	1.95E-6	3.05E-4	3910210107
BR2-15-50	1.5466	80.4981	41.11	5.1911	0.33103	3.91	BR2-15-50	1.45	721.81	1.13E-6	2.45E-4	3910210107
BR2-16-50	1.5457	55.0494	46.03	5.1901	0.33091	4.00	BR2-16-50	1.01	574.19	7.19E-7	1.77E-4	3910210107
BR2-17-50	1.5454	53.8927	48.12	5.1897	0.33086	3.90	BR2-17-50	0.90	530.75	6.30E-7	1.60E-4	3910210107
BR2-18-50	1.5447	92.1533	51.98	5.1890	0.33077	3.96	BR2-18-50	0.68	312.69	8.15E-7	1.62E-4	3910210107
BR2-19-50	1.5446	93.9184	52.97	5.1889	0.33075	3.99	BR2-19-50	0.65	284.72	7.86E-7	1.50E-4	3910210107
BR2-20-50	1.5443	93.5206	55.27	5.1885	0.33070	4.07	BR2-20-50	0.56	270.43	6.83E-7	1.42E-4	3910210107
BR2-21-50	1.5436	93.2330	58.99	5.1878	0.33061	4.01	BR2-21-50		327.40		1.71E-4	3910210107
BR2-22-50	1.5434	93.7384	61.07	5.1875	0.33057	3.89	BR2-22-50	1.10	227.19	1.34E-6	1.20E-4	3910210107
BR2-23-75	1.5401	52.7046	66.07	5.1838	0.33010	3.99	BR2-23-75		2234.17		6.81E-4	3910210107
BR2-24-75	1.5393	52.4100	67.18	5.1830	0.33000	3.92	BR2-24-75		2290.21		6.75E-4	3910210107
BR2-25-75	1.5385	52.0554	68.42	5.1821	0.32998	3.89	BR2-25-75		2213.81		6.48E-4	3910210107
BR2-26-75	1.5382	51.8557	68.97	5.1817	0.32983	4.02	BR2-26-75		2176.71		6.35E-4	3910210107
BR2-27-75	1.5345	53.8464	75.11	5.1776	0.32931	3.90	BR2-27-75		1952.39		5.92E-4	3910210107
BR2-28-75	1.5316	52.7113	80.08	5.1743	0.32889	3.94	BR2-28-75		1980.89		5.88E-4	3910210107
BR2-29-75	1.5302	92.0752	82.13	5.1727	0.32869	4.01	BR2-29-75		1357.00		7.05E-4	3910210107
BR2-30-75	1.5295	93.3586	83.14	5.1720	0.32860	3.92	BR2-30-75		1176.81		6.20E-4	3910210107
BR2-31-75	1.5271	92.2051	87.07	5.1692	0.32825	3.96	BR2-31-75		1183.08		6.16E-4	3910210107
BR2-32-75	1.5260	91.3309	89.05	5.1680	0.32809	3.97	BR2-32-75		1108.72		5.73E-4	3910210107
BR2-33-75	1.5228	92.4210	94.02	5.1643	0.32762	3.86	BR2-33-75		1241.18		6.49E-4	3910210107
BR2-34-75	1.5077	92.4191	122.02	5.1472	0.32545	3.90	BR2-34-75		1029.81		5.39E-4	3910210107
BR2-35-75	1.4826	92.6159	173.07	5.1186	0.32184	3.90	BR2-35-75		928.20		4.90E-4	3910210107
BR2-36-75	1.4395	91.3251	262.01	5.0684	0.31557	3.97	BR2-36-75		920.51		4.85E-4	3910210107
BR2-37-75	1.4079	94.6087	362.00	5.0311	0.31094	4.13	BR2-37-75		567.84		3.16E-4	3910210107
BR2-38-75	1.3931	78.1011	425.10	5.0134	0.30876	3.98	BR2-38-75	1.59	502.62	1.71E-6	2.34E-4	3910210107
BR2-39-75	1.3800	88.7140	515.02	4.9976	0.30682	4.07	BR2-39-75	1.58	279.90	1.90E-6	1.46E-4	3910210107
BR2-40-75	1.3765	274.4960	535.95	4.9934	0.30629	3.67	BR2-40-75	1.49	101.32	5.74E-6	1.68E-4	3910210107
BR2-41-75	1.3750	364.2868	544.08	4.9916	0.30608	4.10	BR2-41-75	1.56	80.83	7.95E-6	1.78E-4	3910210107
% loss	11.52		1038.9	Angstroms								

25 C data	Mass Ceramics	Flow Rate	Run time	Diameter	Surf. Area	pH 6	pH 6	Tl	U	NR-Tl	NR-U	#Particles	
		(g)	(mL/day)	(days)	(microns)	(sq. m)	pH	Start	ppb	g/m^2/day	g/m^2/day		
Start	1.56100		0.00	5.1994	0.33359	6.10	BR3-1-25		1120.48	3.39E-4	3927823666		
BR3-1-25	1.5609	54.3332	0.39	5.1992	0.33357	6.14	BR3-2-25		557.15	1.67E-4	3927823666		
BR3-2-25	1.5604	53.8719	3.00	5.1988	0.3335	6.17	BR3-3-25		404.24	1.20E-4	3927823666		
BR3-3-25	1.5603	53.5121	4.03	5.1986	0.3335	6.15	BR3-4-25		350.56	1.03E-4	3927823666		
BR3-4-25	1.5602	52.9997	5.03	5.1985	0.3335	6.13	BR3-5-25		154.70	4.48E-5	3927823666		
BR3-5-25	1.5599	51.9840	11.18	5.1982	0.3334	6.12	BR3-6-25		194.70	5.81E-5	3927823666		
BR3-6-25	1.5598	51.8055	13.16	5.1981	0.3334	6.17	BR3-7-25		121.80	6.18E-5	3927823666		
BR3-7-25	1.5595	91.3374	17.99	5.1978	0.3334	6.13	BR3-8-25		103.75	5.77E-5	3927823666		
BR3-8-25	1.5595	99.8320	19.04	5.1977	0.3334	6.15	BR3-9-25		97.79	5.52E-5	3927823666		
BR3-9-25	1.5594	101.3477	20.01	5.1976	0.3334	6.12	BR3-10-25		91.03	5.23E-5	3927823666		
BR3-10-25	1.5592	103.1818	23.96	5.1974	0.3333	6.12	BR3-11-25		88.47	4.11E-5	3927823666		
BR3-11-25	1.5591	83.3556	26.01	5.1973	0.3333	6.13	BR3-12-50		171.50	9.32E-5	3927823666		
BR3-12-50	1.5580	97.6452	38.12	5.1980	0.3332	5.97	BR3-13-50		210.33	1.10E-4	3927823666		
BR3-13-50	1.5579	94.1827	39.09	5.1959	0.3331	6.16	BR3-14-50		219.90	1.18E-4	3927823666		
BR3-14-50	1.5578	94.6653	40.16	5.1958	0.3331	6.15	BR3-15-50		238.45	7.61E-5	3927823666		
BR3-15-50	1.5577	57.2836	41.11	5.1957	0.3331	6.07	BR3-16-50		272.30	7.74E-5	3927823666		
BR3-16-50	1.5573	51.0413	46.03	5.1953	0.3331	6.17	BR3-17-50		244.79	6.83E-5	3927823666		
BR3-17-50	1.5572	50.0876	48.12	5.1951	0.3330	6.14	BR3-18-50		197.70	9.37E-5	3927823666		
BR3-18-50	1.5568	85.0041	51.98	5.1947	0.3330	6.12	BR3-19-50		171.92	8.33E-5	3927823666		
BR3-19-50	1.5567	86.8815	52.97	5.1946	0.3330	6.15	BR3-20-50		161.24	7.77E-5	3927823666		
BR3-20-50	1.5565	88.4433	55.27	5.1944	0.3329	6.16	BR3-21-50		191.50	9.17E-5	3927823666		
BR3-21-50	1.5562	85.9048	58.99	5.1941	0.3329	6.14	BR3-22-50		131.08	6.32E-5	3927823666		
BR3-22-50	1.5561	88.5471	61.07	5.1939	0.3329	6.07	BR3-23-75		305.61	8.12E-5	3927823666		
BR3-23-75	1.5557	47.6692	66.07	5.1935	0.3328	6.13	BR3-24-75		319.22	8.40E-5	3927823666		
BR3-24-75	1.5556	47.1719	67.18	5.1934	0.3328	6.07	BR3-25-75						
BR3-25-75	1.5556	0.8739	68.42	5.1934	0.3328	6.00	BR3-26-75						
BR3-26-75	1.5555	39.4941	68.97	5.1933	0.3328	6.14	BR3-27-75		379.12	8.35E-5	3927823666		
BR3-27-75	1.5549	55.2824	75.11	5.1926	0.3327	6.00	BR3-28-75		326.73	1.01E-4	3927823666		
BR3-28-75	1.5543	53.4005	80.08	5.1920	0.3328	6.00	BR3-29-75		393.18	1.17E-4	3927823666		
BR3-29-75	1.5539	95.1558	82.13	5.1916	0.3326	6.08	BR3-30-75		342.37	1.82E-4	3927823666		
BR3-30-75	1.5538	98.3298	83.14	5.1914	0.3326	6.04	BR3-31-75		314.41	1.73E-4	3927823666		
BR3-31-75	1.5531	94.2467	87.07	5.1906	0.3325	6.05	BR3-32-75		321.80	1.69E-4	3927823666		
BR3-32-75	1.5528	92.7625	89.05	5.1903	0.3324	6.08	BR3-33-75		311.71	1.61E-4	3927823666		
BR3-33-75	1.5517	94.6344	94.02	5.1891	0.3323	6.06	BR3-34-75		412.81	2.18E-4	3927823666		
BR3-34-75	1.5425	94.3435	122.02	5.1787	0.3309	5.98	BR3-35-75		626.95	3.30E-4	3927823666		
BR3-35-75	1.5266	94.8928	173.07	5.1810	0.3287	6.12	BR3-36-75		581.78	3.10E-4	3927823666		
BR3-36-75	1.5036	92.5564	262.01	5.1349	0.3254	6.04	BR3-37-75	0.11	494.78	1.28E-7	2.59E-4	3927823666	
BR3-37-75	1.4778	94.6803	362.00	5.1053	0.3216	6.04	BR3-38-75	0.38	478.60	4.72E-7	2.58E-4	3927823666	
BR3-38-75	1.4626	78.7510	425.10	5.0878	0.3194	5.94	BR3-39-75	1.81	529.41	1.90E-6	2.41E-4	3927823666	
BR3-39-75	1.4450	87.1257	515.02	5.0673	0.3169	5.88	BR3-40-75	1.64	386.05	1.91E-6	1.95E-4	3927823666	
BR3-40-75	1.4445	274.7509	535.95	5.0667	0.3168	6.13	BR3-41-75	0.70	16.66	2.80E-6	2.68E-5	3927823666	
BR3-41-75	1.4425	481.2107	544.08	5.0643	0.3165	6.15	BR3-41-75	1.04	87.89	6.81E-6	2.48E-4	3927823666	
% loss		7.59			875.4	Angstroms							

25 C data	Mass Ceramics	Flow Rate	Run time	Diameter	Surf. Area	pH 8	pH 8	Tl	U	NR-Tl	NR-U	#Particles
		(g)	(mL/day)	(days)	(microns)	(sq. m)	pH	Start	ppb	g/m^2/day	g/m^2/day	
Start	1.56900		0.00	5.1994	0.3353	7.85	BR4-1-25		58.40	1.72E-5	3947953448	
BR4-1-25	1.5690	53.1821	0.39	5.1994	0.3353	7.73	BR4-1-25		22.79	6.61E-6	3947953448	
BR4-2-25	1.5690	52.4073	3.00	5.1994	0.3353	7.81	BR4-2-25		21.50	6.22E-6	3947953448	
BR4-3-25	1.5690	52.2949	4.03	5.1994	0.3353	7.69	BR4-3-25		24.24	6.93E-6	3947953448	
BR4-4-25	1.5690	51.6892	5.03	5.1994	0.3353	7.62	BR4-4-25		19.14	5.47E-6	3947953448	
BR4-5-25	1.5689	51.6083	11.18	5.1993	0.3353	7.67	BR4-5-25		22.52	6.28E-6	3947953448	
BR4-6-25	1.5689	50.3931	13.16	5.1993	0.3353	7.68	BR4-6-25		11.74	5.77E-6	3947953448	
BR4-7-25	1.5689	88.8001	17.99	5.1993	0.3353	7.67	BR4-7-25		13.40	7.21E-6	3947953448	
BR4-8-25	1.5689	97.1540	19.04	5.1993	0.3353	7.70	BR4-8-25		14.86	8.00E-6	3947953448	
BR4-9-25	1.5689	97.2287	20.01	5.1993	0.3353	7.74	BR4-9-25		12.23	6.53E-6	3947953448	
BR4-10-25	1.5688	96.4021	23.96	5.1992	0.3353	7.63	BR4-10-25		15.35	8.15E-6	3947953448	
BR4-11-25	1.5688	95.9441	26.01	5.1992	0.3353	7.68	BR4-11-25					

BR4-12-50	1.5688	89.5126	38.12	5.1991	0.3353	7.70	BR4-12-50	11.12	5.51E-6	3947953448		
BR4-13-50	1.5688	87.6511	39.09	5.1991	0.3353	7.57	BR4-13-50	15.43	7.49E-6	3947953448		
BR4-14-50	1.5688	88.6456	40.16	5.1991	0.3353	7.61	BR4-14-50	12.25	6.01E-6	3947953448		
BR4-15-50	1.5687	63.6222	41.11	5.1991	0.3353	7.56	BR4-15-50	12.83	4.52E-6	3947953448		
BR4-16-50	1.5687	57.8807	46.03	5.1991	0.3353	7.72	BR4-16-50	9.67	3.10E-6	3947953448		
BR4-17-50	1.5687	56.8173	48.12	5.1991	0.3353	7.57	BR4-17-50	9.08	2.86E-6	3947953448		
BR4-18-50	1.5687	95.4430	51.98	5.1991	0.3353	7.47	BR4-18-50	4.60	2.43E-6	3947953448		
BR4-19-50	1.5687	99.0200	52.97	5.1991	0.3353	7.67	BR4-19-50	2.46	1.35E-6	3947953448		
BR4-20-50	1.5687	98.8491	55.27	5.1991	0.3353	7.57	BR4-20-50	4.53	2.48E-6	3947953448		
BR4-21-50	1.5687	98.2642	58.99	5.1991	0.3353	7.58	BR4-21-50	3.57	1.94E-6	3947953448		
BR4-22-50	1.5687	98.9929	61.07	5.1991	0.3353	7.64	BR4-22-50	3.34	1.83E-6	3947953448		
BR4-23-75	1.5687	57.7884	66.07	5.1991	0.3353	7.65	BR4-23-75	4.70	1.51E-6	3947953448		
BR4-24-75	1.5687	53.2928	67.18	5.1990	0.3353	7.70	BR4-24-75	22.05	6.50E-6	3947953448		
BR4-25-75	1.5687	54.4197	68.42	5.1990	0.3352	7.63	BR4-25-75	1.62	13.67	1.13E-6	4.12E-6	3947953448
BR4-26-75	1.5687	11.1814	68.97	5.1990	0.3352	0.00	BR4-26-75				3947953448	
BR4-27-75	1.5687	58.8727	75.11	5.1990	0.3352	7.72	BR4-27-75		7.36	2.40E-6	3947953448	
BR4-28-75	1.5686	55.0239	80.08	5.1990	0.3352	7.68	BR4-28-75	1.95	23.60	1.37E-6	7.19E-6	3947953448
BR4-29-75	1.5686	97.6117	82.13	5.1990	0.3352	7.85	BR4-29-75	1.12	26.57	1.39E-6	1.44E-5	3947953448
BR4-30-75	1.5686	98.1866	83.14	5.1989	0.3352	7.68	BR4-30-75	1.70	31.44	2.13E-6	1.71E-5	3947953448
BR4-31-75	1.5685	97.9279	87.07	5.1988	0.3352	7.60	BR4-31-75	0.96	38.89	1.20E-6	2.11E-5	3947953448
BR4-32-75	1.5685	96.9251	89.05	5.1988	0.3352	7.69	BR4-32-75		35.09	1.88E-5	3947953448	
BR4-33-75	1.5683	98.1081	94.02	5.1986	0.3352	7.69	BR4-33-75	1.04	59.02	1.30E-6	3.21E-5	3947953448
BR4-34-75	1.5674	95.7148	122.02	5.1976	0.3351	7.86	BR4-34-75		63.95	3.39E-5	3947953448	
BR4-35-75	1.5652	94.1010	173.07	5.1952	0.3348	7.70	BR4-35-75		81.70	4.28E-5	3947953448	
BR4-36-75	1.5593	93.2220	262.01	5.1887	0.3339	7.65	BR4-36-75		127.15	6.57E-5	3947953448	
BR4-37-75	1.5530	97.2652	362.00	5.1816	0.3330	7.84	BR4-37-75		117.81	6.38E-5	3947953448	
BR4-38-75	1.5490	80.8991	425.10	5.1772	0.3324	7.71	BR4-38-75	1.79	139.33	1.86E-6	6.28E-5	3947953448
BR4-39-75	1.5440	89.3116	515.02	5.1716	0.3317	7.47	BR4-39-75	1.85	112.40	2.13E-6	5.80E-5	3947953448
BR4-40-75	1.5433	339.8283	535.95	5.1709	0.3316	7.45	BR4-40-75	1.91	16.24	8.40E-6	3.09E-5	3947953448
BR4-41-75	1.5430	422.2256	542.01	5.1706	0.3316	7.77	BR4-41-75	1.89	20.60	1.03E-5	4.87E-5	3947953448
% loss	1.66		144.2	Angstroms								

25 C data	Mass Ceramics	Flow Rate	Run time	Diameter	Surf. Area								#Particles
pH 10	(g)	(mL/day)	(days)	(microns)	(sq. m)	pH	pH 10	Tl	U	NR-Tl	NR-U	g/m^2/day	g/m^2/day
Start	1.56000		0.00	5.1994	0.3334	10.01	Start	ppb	ppb	4.82E-7	4.40E-5	3925307444	
BR5-1-25	1.5600	55.7366	0.39	5.1994	0.3334	9.98	BR5-1-25	0.89	141.87		1.28E-5	3925307444	
BR5-2-25	1.5599	54.4790	3.00	5.1993	0.3334	9.89	BR5-2-25		42.17		1.03E-5	3925307444	
BR5-3-25	1.5599	53.0221	4.03	5.1993	0.3334	9.91	BR5-3-25		34.93		9.18E-6	3925307444	
BR5-4-25	1.5599	53.6529	5.03	5.1993	0.3334	9.92	BR5-4-25		30.66		5.57E-6	3925307444	
BR5-5-25	1.5599	52.2801	11.18	5.1993	0.3334	9.94	BR5-5-25		19.15		6.39E-6	3925307444	
BR5-6-25	1.5599	52.2871	13.16	5.1993	0.3334	9.92	BR5-6-25		21.94		9.44E-6	3925307444	
BR5-7-25	1.5598	92.6265	17.99	5.1992	0.3333	9.96	BR5-7-25		18.30		8.64E-6	3925307444	
BR5-8-25	1.5598	101.4026	19.04	5.1992	0.3333	9.95	BR5-8-25		15.29		8.66E-6	3925307444	
BR5-9-25	1.5598	101.5635	20.01	5.1992	0.3333	9.96	BR5-9-25		15.32		9.02E-6	3925307444	
BR5-10-25	1.5598	101.2832	23.96	5.1992	0.3333	9.94	BR5-10-25		17.42		9.64E-6	3925307444	
BR5-11-25	1.5598	99.7224	26.01	5.1991	0.3333	9.92	BR5-11-25		17.36		1.36E-5	3925307444	
BR5-12-50	1.5598	94.9880	38.12	5.1989	0.3333	9.86	BR5-12-50		25.76		9.81E-6	3925307444	
BR5-13-50	1.5598	92.5279	39.09	5.1989	0.3333	9.96	BR5-13-50		19.05		8.73E-6	3925307444	
BR5-14-50	1.5598	94.1982	40.16	5.1989	0.3333	9.77	BR5-14-50		16.64		2.36E-5	3925307444	
BR5-15-50	1.5598	61.0833	41.11	5.1989	0.3333	9.78	BR5-15-50		15.43		4.24E-5	3925307444	
BR5-16-50	1.5598	56.7925	46.03	5.1989	0.3333	9.77	BR5-16-50		7.58		4.92E-5	3925307444	
BR5-17-50	1.5598	54.7861	48.12	5.1989	0.3333	9.71	BR5-17-50		15.88		1.62E-5	3925307444	
BR5-18-50	1.5598	94.5858	51.98	5.1988	0.3333	9.71	BR5-18-50		23.24		1.82E-5	3925307444	
BR5-19-50	1.5598	98.6840	52.97	5.1988	0.3333	9.80	BR5-19-50		30.15		2.05E-4	3925307444	
BR5-20-50	1.5594	98.3777	55.27	5.1988	0.3333	9.70	BR5-20-50		44.01		2.22E-5	3925307444	
BR5-21-50	1.5593	95.6491	58.99	5.1988	0.3333	9.71	BR5-21-50		78.59		4.24E-5	3925307444	
BR5-22-50	1.5592	96.3567	61.07	5.1985	0.3333	9.74	BR5-22-50		91.64		4.92E-5	3925307444	
BR5-23-75	1.5591	54.8086	66.07	5.1984	0.3333	9.70	BR5-23-75		18.78		5.73E-6	3925307444	
BR5-24-75	1.5591	51.7928	67.18	5.1984	0.3332	9.61	BR5-24-75		62.93		1.82E-5	3925307444	
BR5-25-75	1.5591	0.8026	68.42	5.1984	0.3332	0.00	BR5-25-75				2.22E-5	3925307444	
BR5-26-75	1.5591	44.0603	68.97	5.1984	0.3332	9.43	BR5-26-75		90.50		2.22E-5	3925307444	
BR5-27-75	1.5588	56.6008	75.11	5.1981	0.3332	9.70	BR5-27-75		167.17		5.27E-5	3925307444	
BR5-28-75	1.5583	56.0458	80.08	5.1975	0.3331	9.52	BR5-28-75		312.60		9.78E-5	3925307444	
BR5-29-75	1.5580	97.4158	82.13	5.1971	0.3331	9.67	BR5-29-75		306.43		1.66E-4	3925307444	
BR5-30-75	1.5578	98.7065	83.14	5.1969	0.3331	9.85	BR5-30-75		319.87		1.78E-4	3925307444	
BR5-31-75	1.5570	97.2668	87.07	5.1960	0.3329	9.65	BR5-31-75		377.80		2.05E-4	3925307444	
BR5-32-75	1.5566	98.4758	89.05	5.1956	0.3329	9.70	BR5-32-75		353.00		1.90E-4	3925307444	
BR5-33-75	1.5554	95.9839	94.02	5.1943	0.3327	9.51	BR5-33-75		451.78		2.42E-4	3925307444	
BR5-34-75	1.5515	94.4998	122.02	5.1900	0.3322	9.75	BR5-34-75		262.17		1.38E-4	3925307444	
BR5-35-75	1.5439	93.7382	173.07	5.1814	0.3311	9.69	BR5-35-75		287.31		1.50E-4	3925307444	
BR5-36-75	1.5267	93.6218	262.01	5.1621	0.3286	9.51	BR5-36-75		387.50		1.93E-4	3925307444	
BR5-37-75	1.5166	98.0717	362.00	5.1507	0.3272	9.53	BR5-37-75		182.49		1.01E-4	3925307444	
BR5-38-75	1.5088	82.0205	425.10	5.1419	0.3260	9.47	BR5-38-75	1.39	264.87	1.50E-6	1.23E-4	3925307444	
BR5-39-75	1.4949	91.6910	515.02	5.1261	0.3240	9.14	BR5-39-75	1.45	295.47	1.75E-6	1.54E-4	3925307444	
BR5-40-75	1.4920	301.6731	535.85	5.1228	0.3236	9.54	BR5-40-75	1.40	80.51	5.58E-6	1.39E-4	3925307444	
BR5-41-75	1.4913	325.4120	542.01	5.1219	0.3235	9.79	BR5-41-75	1.37	67.98	5.89E-6	1.27E-4	3925307444	
% loss	4.41			387.6	Angstroms								

25 C data	Mass Ceramics	Flow Rate	Run time	Diameter	Surf. Area							#Particles	
pH 12	(g)	(mL/day)	(days)	(microns)	(sq. m)	pH	pH 12	Tl	U	NR-Tl	NR-U	g/m^2/day	g/m^2/day
Start	1.56300		0.00	5.1994	0.3340	12.09	Start	ppb	ppb	334.24	1.01E-4	3932856112	
BR6-1-25	1.5630	54.1603	0.39	5.1994	0.3340	12.17	BR6-1-25				3.14E-5	3932856112	
BR6-2-25	1.5629	52.8807	3.00	5.1993	0.3340	12.14	BR6-2-25		106.72		5.20E-5	3932856112	
BR6-4-25	1.5628	72.6290	5.03	5.1991	0.3340	12.21	BR6-4-25	1.53	128.77	1.43E-6	1.32E-5	3932856112	
BR6-5-25	1.5627	68.8128	11.18	5.1991	0.3340	12.24	BR6-5-25		35.67		1.21E-5	3932856112	
BR6-6-25	1.5627	50.9205	13.16	5.1990	0.3340	12.19	BR6-6-25		42.87		1.94E-5	3932856112	
BR6-7-25	1.5626	73.0577	17.99	5.1989	0.3340	12.24	BR6-7-25		47.88		2.37E-5	3932856112	
BR6-8-25	1.5625	91.4909	19.04	5.1989	0.3339	12.18	BR6-8-25		46.57		2.38E-5	3932856112	
BR6-9-25	1.5625	93.1659	20.01	5.1989	0.3339	12.18	BR6-9-25		46.04		2.89E-5	3932856112	
BR6-10-25	1.5624	92.5360	23.96	5.1987	0.3339	12.22	BR6-10-25		56.12		3.02E-5	3932856112	
BR6-11-25	1.5624	92.4592	26.01	5.1987	0.3339	12.19	BR6-11-25		58.82		2.67E-5	3932856112	
BR6-12-50	1.5620	48.9071	38.12	5.1983	0.3339	11.88	BR6-12-50		98.15		2.17E-5	3932856112	
BR6-13-50	1.5620	48.0448	39.09	5.1983	0.3339	12.28	BR6-13-50		81.30				

BR6-14-50	1.5620	-26.8451	40.16	5.1983	0.3339	0.00	BR6-14-50				3932856112	
BR6-15-50	1.5620	56.5563	41.11	5.1983	0.3339	12.04	BR6-15-50	7.07	2.22E-6	3932856112		
BR6-16-50	1.5618	53.9073	46.03	5.1981	0.3338	12.12	BR6-16-50	127.98	3.84E-5	3932856112		
BR6-17-50	1.5617	52.4063	48.12	5.1980	0.3338	12.00	BR6-17-50	132.41	3.86E-5	3932856112		
BR6-18-50	1.5615	93.1407	51.98	5.1977	0.3338	11.98	BR6-18-50	138.84	7.19E-5	3932856112		
BR6-19-50	1.5614	96.2249	52.97	5.1976	0.3338	12.10	BR6-19-50	129.34	6.92E-5	3932856112		
BR6-20-50	1.5612	95.5667	55.27	5.1974	0.3338	11.96	BR6-20-50	129.66	6.89E-5	3932856112		
BR6-21-50	1.5609	96.5494	58.99	5.1971	0.3337	12.04	BR6-21-50	142.24	7.64E-5	3932856112		
BR6-22-50	1.5608	96.5288	61.07	5.1970	0.3337	12.17	BR6-22-50	118.19	6.35E-5	3932856112		
BR6-23-75	1.5605	60.4827	66.07	5.1967	0.3337	12.03	BR6-23-75	171.38	5.77E-5	3932856112		
BR6-24-75	1.5605	61.2880	67.18	5.1966	0.3336	11.94	BR6-24-75	197.45	6.73E-5	3932856112		
BR6-25-75	1.5604	58.3943	68.42	5.1965	0.3336	12.00	BR6-25-75	210.71	6.84E-5	3932856112		
BR6-26-75	1.5603	60.7897	68.97	5.1964	0.3336	11.95	BR6-26-75	232.36	7.88E-5	3932856112		
BR6-27-75	1.5598	60.9743	75.11	5.1958	0.3335	12.20	BR6-27-75	274.71	9.32E-5	3932856112		
BR6-28-75	1.5592	60.3274	80.08	5.1952	0.3335	11.93	BR6-28-75	321.39	1.08E-4	3932856112		
BR6-29-75	1.5589	90.5408	82.13	5.1948	0.3334	12.17	BR6-29-75	324.74	1.64E-4	3932856112		
BR6-30-75	1.5587	90.0266	83.14	5.1946	0.3334	12.13	BR6-30-75	311.13	1.56E-4	3932856112		
BR6-31-75	1.5581	91.2340	87.07	5.1939	0.3333	12.15	BR6-31-75	327.87	1.67E-4	3932856112		
BR6-32-75	1.5578	89.8133	89.05	5.1936	0.3333	12.18	BR6-32-75	306.27	1.53E-4	3932856112		
BR6-33-75	1.5569	89.4808	94.02	5.1926	0.3331	12.11	BR6-33-75	351.85	1.75E-4	3932856112		
BR6-34-75	1.5519	89.5870	122.02	5.1871	0.3324	12.02	BR6-34-75	356.42	1.78E-4	3932856112		
BR6-35-75	1.5445	83.0544	173.07	5.1788	0.3314	12.08	BR6-35-75	312.41	1.45E-4	3932856112		
BR6-36-75	1.5327	83.0151	262.01	5.1655	0.3297	12.14	BR6-36-75	286.83	1.33E-4	3932856112		
BR6-37-75	1.5256	74.0140	362.00	5.1576	0.3287	12.02	BR6-37-75	168.89	7.04E-5	3932856112		
BR6-38-75	1.5225	53.4642	425.10	5.1541	0.3282	11.91	BR6-38-75	1.30	164.84	9.07E-7	4.98E-5	3932856112
BR6-39-75	1.5200	65.0058	515.02	5.1513	0.3279	11.98	BR6-39-75	1.10	73.86	9.36E-7	2.71E-5	3932856112
BR6-40-75	1.5185	279.5237	535.95	5.1498	0.3276	11.75	BR6-40-75	1.47	45.56	5.38E-6	7.21E-5	3932856112
BR6-41-75	1.5180	411.2356	544.08	5.1490	0.3276	11.82	BR6-41-75	1.17	30.31	8.31E-6	7.06E-5	3932856112
% loss	2.88		252.1	Angstroms								